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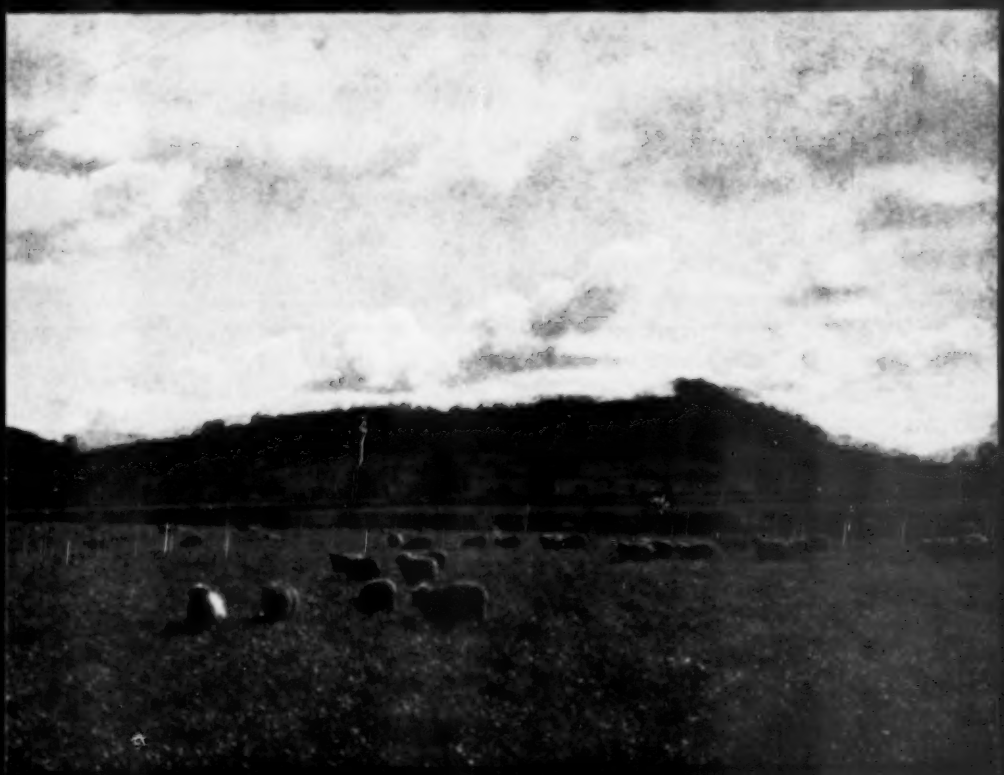

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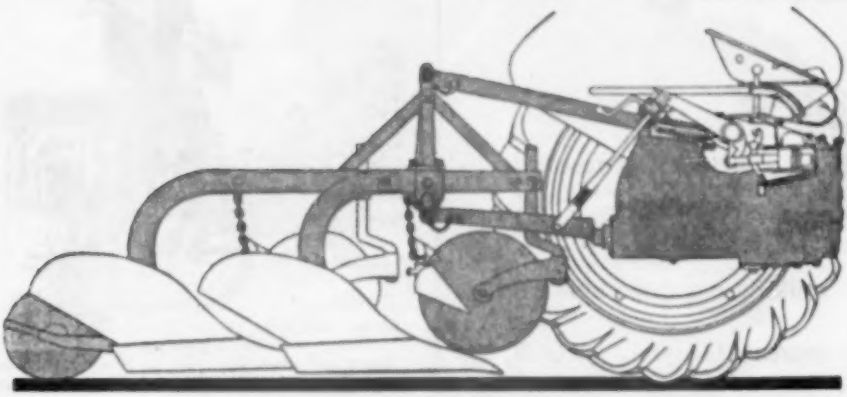

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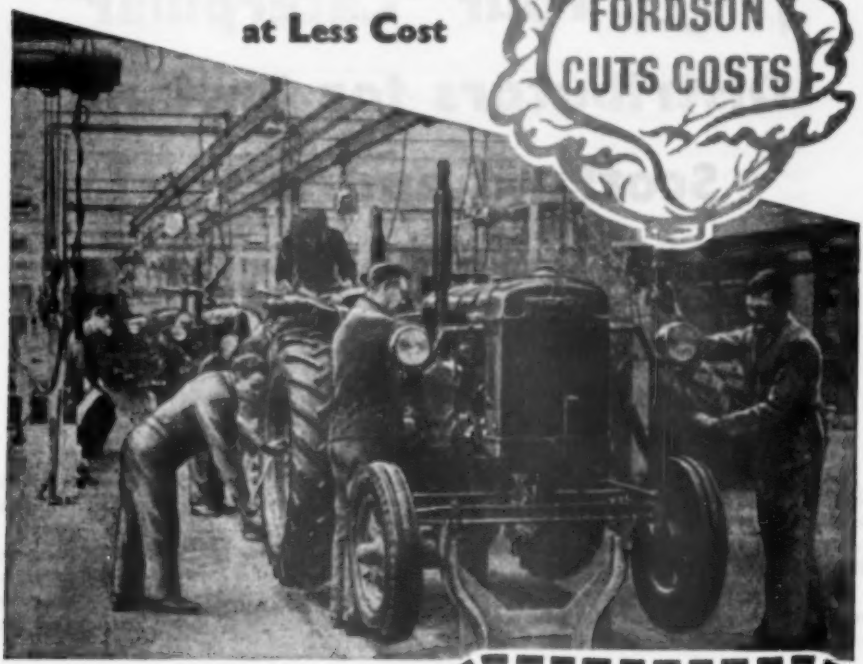

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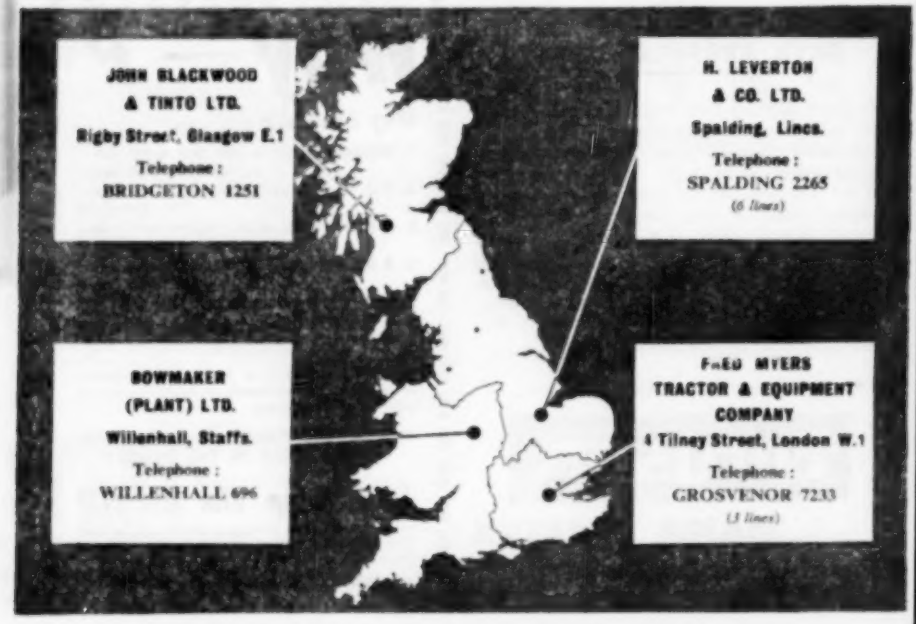

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Cover Photograph

Sheep on Winter Wheat in March *Eagle Photo*

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AGRICULTURE

THE JOURNAL OF THE MINISTRY OF AGRICULTURE

VOL LVII No. 12 MARCH 1951

PROFITS FROM SHEEP ON THE GENERAL FARM

W. HARWOOD LONG, M.A.

Department of Agriculture, University of Leeds

THE profitability of sheep on the general farm depends upon a number of factors, not all of which, of course, will exercise the same degree of influence everywhere and at all times. For the purpose of this present (admittedly limited) assessment, I have taken three sets of figures. One set refers to the sheep account of a mixed farm in the North Riding. The second set is taken from an East Riding arable farm, and the third is based on an investigation conducted by the Agricultural Economics Department of Manchester University into the costs of sheep kept on general farms in Lancashire and Cheshire.

North Riding Farm Mr. George Chrystal farms some 300 acres at Woodhouse, Middleton Tyas, between Richmond and Darlington. Nearly 100 acres are permanent pasture, the arable is run on a seven-course rotation which includes a four-year ley. This gives him altogether rather more than 200 acres of grass, permanent and temporary, of which 40 acres are shut up at the beginning of May each year for hay or silage. He grazes his grass with sheep and cattle. He has 130 cattle in summer, and he winters 40 outside. His method is to buy steers in the spring, usually locally or in the neighbouring Dales, at 15–18 months old and to keep them until they are fat or ready for someone else to fatten. Most of his cattle, therefore, spend one winter on the farm, and two summers.

The sheep comprise a flock of 140 to 160 Masham ewes and the progeny of their union to an Oxford tup. The lambs are weaned in August and are sold from then onwards, sometimes fat, at other times store, according to the market. Mr. Chrystal estimates that his sheep consume 50 acres of grass, as well as 3½ acres of oats and ½ acre of mangolds.

In 1913 Mr. Chrystal sought the advice of the Agricultural Economics Research Institute, Oxford, on a system of costing his farm. The advice he received at that time has proved so practical and the results so useful that he has kept detailed costs of each of the enterprises of his farm from 1913 to the present time. For the purpose of this paper I have taken the average results of the three years 1947–48 to 1949–50. Table 1 gives the costs and returns *per ewe*. These returns, of course, are represented mainly by the sales of lambs, and on the basis of 233 lambs from 147 ewes they brought in an average of nearly £8. The wool from the ewes increased the total to nearly £8 10s.

The main item of expense was grazing, and this with other foods totalled over £3 per ewe. Depreciation of the ewes—mainly the difference between the cost of replacements and the price received for draft ewes—was over £1. Establishment costs were about 14s. and include fencing and hedging and such general farm expenses as cannot be allocated directly to any of the productive branches of the farm.

The profit per ewe was just over 50s. Mr. Chrystal regards his land as being capable of maintaining three ewes (and their followers) per acre; thus his profit per acre under sheep amounted to £7 10s.

Table 1

Costs and Returns per ewe 1947–48 to 1949–50. (Mr. G. Chrystal, Middleton Tyas)

Av. no. ewes		147	
Av. no. lambs		233	
		per ewe	
COST		£	*s. d.*
Grazing		2	4 6
Other foods			19 10
Labour			11 4
Sundries			6 3
Depreciation		1	2 0
Establishment			13 11
		5	17 10
OUTPUT			
Lambs		7	18 2
Wool			10 6
		8	8 8
PROFIT		2	10 10

East Riding Farm Mr. C. Rounthwaite farms at Lingcroft, Fulford, just outside York. Of his 172 acres, 162 are arable. The soil is light ; half the farm is on blow-away sand and half is sandy loam. Generally speaking, Mr. Rounthwaite follows a two-course rotation—corn and roots. It is one which permits a very intensive form of farming, and in recent years his sales have usually exceeded £50 an acre over the whole farm. But, of course, he can do this only by carefully maintaining soil fertility. He makes about 300 tons of foldyard dung per year, which enables him to give a dressing of 10 tons per acre to 30 acres of root land. He also buys about 50 tons of shoddy, and, of course, spends heavily on "tillage". But with so much light land he also finds it necessary to put some leys down for a three- or four-year period for the sake of the organic content. The produce of the leys must be consumed in some way or other, and Mr. Rounthwaite finds that sheep serve his purpose better than any other class of stock. He has no breeding flock, and his method is to buy hoggs at the end of March or beginning of April, run them on the seeds during the summer and early autumn, and sell them when they have had a month or two on sugar beet tops—but at any rate before Christmas.

Mr. Rounthwaite followed this method in 1949, when he bought 52 cross-bred Oxford hoggs for £7 each at the end of March. They were bought at a grading centre, and Mr. Rounthwaite paid slightly more than the price they would have made on the basis of the graders' estimate of their weight. He put them on to a 9-acre first-year seeds field, where they stayed until mid-July ; then they were given the run of a 13-acre field of seeds fog in addition. This

lasted them until the middle of October and they were then put on sugar beet tops. Here they stayed until they were sold on December 12. Some were graded at 100 lb. dead weight and the rest at 101 lb.—they must therefore have increased by some 40 lb. dead weight over the period—about 1 lb. per head per week.

In the following calculations no account has been taken of casualties: the costs are presented to show what increase in value may be expected from the seeds and beet tops, assuming all the sheep at the beginning of the period live to be graded.

	£	s.	d.
Graded value of sheep, 100 lb. dead weight at 2*s.* 2*d.* per lb.	10	16	8
Wool		18	0
	11	14	8
Less cost of hogg in spring	7	0	0
Profit ..	4	14	8

By making some assumptions it is possible to work out from this figure the gross output of sheep and wool per acre of seeds. Thus 52 sheep at £4 14s. 8d. each gives a total production of £246. This was from 9 acres of maiden seeds, 13 acres of seeds fog, and the sugar beet tops. It is usual to reckon 3 acres of fog as being equal to 1 acre of maiden seeds, and at this ratio the total (adjusted) acreage of seeds becomes 13. It is difficult to allow for the acreage of sugar beet tops on which the hoggs spent their last two months, because the tops were a subsidiary by-product in the growing of a cash crop. Moreover, in the opinion of most people competent to judge, the yield of the succeeding crop is greater when the tops have been sheeped off than by any other way of disposing of them. For the purpose of my argument, therefore, I have ignored the acreage of beet, and I have divided the total output of sheep, £246, by the adjusted acreage of seeds—13 acres altogether. This gives an output of roughly £19 an acre, out of which all expenses of growing the seeds and of keeping the sheep have to be met. These, in fact, were not great: they include the cost of a normal seeds mixture, the cost of preparing the land for it, and the expenses directly connected with the sheep, particularly fencing, shearing, and shepherding. No corn or other hand feed was fed to them.

An output of £19 an acre possibly shows the sheep in rather too good a light, since there is no doubt that such a high figure would not have been achieved without the sugar beet tops. But compared with alternative crops, like corn and potatoes, this method of utilizing some of the land is very satisfactory. For one thing, the expenses are low, so that the difference in the value of sales per acre between seeds sheeped off and corn or potatoes is much greater than the difference in the net profit per acre. But what is much more important, it is a method of turning the land to profitable use while it is at the same time recuperating from the effects of exhaustive crops. The maintenance of fertility, especially organic matter, is a major problem in a system like Mr. Rounthwaite's, and the cost of buying it (in shoddy or fertilizer) or making it (by winter feeding cattle) is the real comparison to make with his return from sheep. It is true that every acre he devotes to sheep will prevent his making the bigger profit that he could almost certainly secure by growing a cash crop. But this would involve finding food for wintering more cattle in his yards, and with virtually no permanent pasture Mr. Rounthwaite is badly placed for doing this economically. The alternative is shoddy, which

is a cash expense. It seems reasonable, therefore, to assume that sheep introduced into an arable system like Mr. Rounthwaite's add materially to the net farm profit, besides helping to allay any fears as to the suitability of his system in maintaining fertility.

Lancashire and Cheshire Dairy Farms It is a bad practice to generalize from the particular, and I should not like to create an impression that I had based my views on the profits of sheep from the experiences of two men only, both of whom, it might be argued, are more successful than the general run of farmers. I have, therefore, looked into two reports on grass sheep issued by the University of Manchester for the years 1947–48 and 1948–49. They are based on the costs of twelve breeding flocks in the first year and thirteen in the second. On all the farms sheep are run as a side line, usually following dairy cows to use surplus grass, root and other fodder crops. These farms averaged 165 acres in size, but as they carry a herd of 40–50 cows it is easy to see that dairying is by far their most important enterprise. Some of them rear their own replacements, too, and the average number of young stock was 20 per farm. Sheep, therefore, have a quite minor role in the farming system ; nevertheless, it is usual for these farmers to keep a flock of about 60 half-bred or Masham ewes.

Table 2 shows the average returns from keeping sheep on Lancashire and Cheshire farms in 1947–48 and 1948–49. The main expense was grazing; this with other foods totalled £2 2s. 8d. per ewe, and depreciation came to very nearly £1. Returns averaged £7 16s. and the net profit amounted to £3 17s. 7d. per ewe.

Table 2

Costs and Returns per ewe 1947–49 and 1948–49 (Lancashire and Cheshire Dairy Farms)

Av. no. ewes	about	60	
		per ewe	
		£	*s. d.*
COST			
Grazing		1	10 8
Other foods			12 0
Labour			13 6
Sundries			2 10
Depreciation			19 5
Establishment			
		3	18 5
OUTPUT			
Lambs		7	5 1
Wool			10 11
		7	16 0
MARGIN		3	17 7

The report from Manchester mentions that no assessment has been made of overheads in costing these flocks. Overheads were entered at 14s. per head in Mr. Chrystal's costs, and to this extent the Manchester costs and Mr. Chrystal's are not comparable. In most other items, the costs on Mr. Chrystal's sheep were higher than those on the other side of the Pennines and, omitting overheads, the total difference amounted to 28s. 6d. per head. But the output on Mr. Chrystal's sheep was 13s. per head higher than in Lancashire and Cheshire, so that the net difference was no more than 15s. 6d. This difference equals almost exactly the higher charge for grazing on Mr.

Chrystal's farm. It is not at first easy to see why the cost for grazing should have been so much greater at Woodhouse because, although Mr. Chrystal spends heavily on seeds and manures, he ought to be able to stock more heavily as a result and he should consequently reduce his costs per head. However, the division of grazing between the various classes of stock—on these farms sheep and cattle—is one that can be done only on an arbitrary basis, and it is quite possible that the proportion charged against the sheep at Woodhouse, where the sheep are an important branch of the farm (someone called them "paying guests") was greater than in Lancashire and Cheshire, where they fulfil the function of scavengers only.

But the object of this comparison is not to explain why the costs in the Manchester report differ from Mr. Chrystal's, but to see to what extent the results from the greater number of farms confirm the conclusions that are suggested by the detailed records kept by Mr. Chrystal. For this purpose they are valuable for although they show differences, in no way do they suggest that Mr. Chrystal's returns are too optimistic. If anything, the Woodhouse costs paint too gloomy a picture, for Mr. Chrystal realizes that he could, by reducing his numbers of sheep, increase his profit per head. But he knows that his sheep pay better than his cattle, and it is worth his while to be relatively heavily stocked with cattle, even though this reduces his profit per head from sheep. It is reasonable, therefore, to expect that many mixed farmers, introducing a few sheep on their farms for the first time, should add more to their profits than would follow from multiplying the number of sheep by Mr. Chrystal's profit per head.

But this, of course, depends as much on how the individual can fit a flock of sheep into a system of farming that is already in working order. The increases in stock-carrying capacity that should follow the greater proportion of grassland in the last year or two and the improvements that are now being incorporated in grassland husbandry give farmers an opportunity to increase their numbers of sheep. Whether they will consume their extra grass more profitably by keeping sheep rather than by keeping some other class of stock is not for me to say. I have tried merely to show that sheep on the general farm *are* profitable. Whether they are more profitable than some other ways of utilizing the grazing must depend on factors which affect individual farms differently. But it is clear at any rate that a few sheep can be kept on a mixed farm without any extra capital expenditure other than on the sheep themselves, and with very little extra labour.

The same might be true of extending the size of a dairy herd and, if so, the profit from extra milk would in present circumstances probably exceed the profit from the sheep. But if extra buildings or alterations to the cow byres to make room for two more cows were required, or if extra labour was necessary to milk the cows, then it might well prove more profitable to consume the extra keep with sheep, whose demands in labour and capital are so much lighter than those of dairy stock. The point that I am trying to make is epitomized by the following quotation from a Welsh report on lowland sheep costs: "A typical farmer in Wales, faced with the problem of finding adequate and suitable labour, might well consider maintaining a small efficient dairy herd, together with a reasonably sized sheep flock, rather than a large dairy herd of poorer quality less efficiently managed."*

The assistance given by Mr. George Chrystal and Mr. C. Rounthwaite in providing details of their costings is gratefully acknowledged.

*Roberts, B. H., "Sheep Production". University College of Wales, 1949, p. 21.

QUALITY STOCK FROM WALES

R. L. JONES, M.B.E.

Penwenallt, Newcastle Emlyn, Carmarthenshire

WHEN I took over Penwenallt in 1916 the livestock policy was based on the production of store cattle, skim milk being fed to calves and the cream manufactured into butter for local sale, and, as was the general practice in Cardiganshire at that time, stores were sold for fattening on the rich pastures of the Midlands and Southern England.

The herd consisted of commercial Shorthorn cows of dual-purpose type, able to produce a calf of good conformation. In addition to the calves bred from these cows, a number of other calves were bought from smallholders and the few producer-retailers from the nearby urban areas. The cows were hand milked and the calves pail-fed, the allowance for each calf being one gallon of whole milk per day in the early stages, increasing gradually to two gallons.

When the calves were accustomed to dry food, the ration of whole milk was reduced and replaced by skim milk, which was fed until six months old. This method gave the calf a good start—and a good start is essential to successful rearing ; if a calf is stinted in the early stages, it is not likely to develop its utmost potential later in life, whether it is a heifer for herd replacement or a beast destined for the butcher's block.

The cattle which I originally took over presented me with several difficulties. They consisted of twelve cows of Shorthorn type, headed by a non-pedigree Shorthorn bull, and some forty young cattle, mixed in type and of unknown possibilities. The problems which confronted me were :

1. To increase the number of calves.
2. To increase the milking capabilities of my herd and the butterfat content of my milk.
3. To attain these objectives and at the same time maintain a conformation capable of producing a good store beast.
4. To build up a self-contained herd of pure-bred, healthy cattle embodying all these qualities.

Obviously, the first essential was to ascertain the milking capabilities of my cows. Hitherto it was pure guess-work. There was no organized method of milk recording except by arrangement with a Breed Society, so it was decided to set up a system of private recording which would enable me to ascertain the number of pounds of milk required to produce 1 lb. of butter ; the amount was found to vary between 22 and 30 lb. according to the season.

Armed with the information obtained from recording, selection was now practicable. It was decided at the outset that not only the lowest yielders should be culled, but also those not attaining the standard of type necessary for breeding a store animal—and, indeed, some high yielders were disposed of for this reason. The first year of private recording showed an average yield of 5,512 lb., rising in the second to 5,688 lb. and further increased in

the third year to 6,789 lb. From these figures it was apparent that the original herd was carrying a high percentage of passengers who were consuming rations which should be used to better advantage. Here I would emphasize that it is quite impossible to lay the foundation of a herd, to maintain improvement and to feed economically, without precise records of milk production.

Recording Pays Dividends In 1919 a further step in the improvement of the herd was taken when, since I wished to grade up my herd through the grading register, I became a member of the Dairy Shorthorn Association. At this time there was no milk recording society in Wales, so I approached the Association, which undertook the work of recording my herd. I remember Mr. Ling of the Association telling me on his first visit to my herd that the nearest recorded herd to mine was 100 miles away ! I continued to record and it paid very handsome dividends, the first being that after my first year's official recording, three of my cows qualified for approval as foundation cows in the grading register. Two of these were bought as calves from smallholders who kept one cow only and they could not afford to keep low yielders. A descendant of one of these cows was female champion at the Bath and West Show in 1948.

My next step was to obtain better progeny from the foundation stock, and the first qualified Shorthorn bull was purchased in 1922. From this time forward great care was taken in the selection of sires, breeding was carefully considered, conformation of ancestors scrutinized, and consistency of yields in the female lines accepted in preference to the occasional phenomenal performance. Careful note was made of the environment of the herd from which the bull was acquired, the ideal being a herd managed under conditions identical with my own. Account was also taken of the average yields of all the cows in the herd, not the few high yields that were put forward for window dressing.

Only a few foundation cows were registered in later years, it being considered advisable to concentrate on the female progeny of the three original foundation cows. The result was that by 1926 two female calves were accepted for entry into Coates's Herd Book. In 1932 a heifer calf descended from the third foundation cow was entered in the Herd Book.

To hasten the building of a pedigree herd, I bought my first pedigree female, "Bertha," in 1921. She was a daughter of the noted bull, "Dunstan 29th," sire of many good cows in the Cranford Herd and which was sold for export to the U.S.A. when eight years old. This cow gave 8,014 lb. in 256 days in the lactation following purchase, and, although retained in the herd until she was 16 years old, she produced only two heifer calves out of ten. Now we have several of her descendants in our possession.

In the next ten years eight pedigree females were bought in, but only one of these gave a satisfactory milk yield. I was now convinced that the steer trade was of minor importance and that concentration on milk production was essential. The average yield of ten full-time cows and heifers was only 5,046 lb., and this low figure convinced me that I still had too many unprofitable cows, so I decided to hold a draft sale to make room for better stock. In 1931 a fresh start was made by retaining eight heifers as a herd nucleus ; these were descendants of "Bertha" and two of the original foundation cows. From this time even greater care was taken in the selection of dairy bulls. Three bulls in particular have been responsible for improve-

ment in performance and conformation of the herd. They are :

"*Kelmscott Ajax*" (purchased 1934) a brother of "Kelmscott Darlington" (a very successful cow in the show-ring), by Kelmscott Ringleader 26th, sire of several prize-winning cows. Twelve of Ajax's daughters qualified.

"*Whitecroft Dairyman*" I.R.M. (purchased 1938) out of a twice 2,000-gallon cow which averaged 15,438 lb. with six calves. 17 pedigree females by this bull were retained, of which 14 qualified, averaging 7,153 lb. with their first calves.

"*Gwili Ideal*" I.R.M. (purchased 1941) then a 5-year-old proven bull, his progeny having been carefully inspected prior to purchase. His dam gave 13,337 lb. with her fifth calf under conditions of management similar to those of my own herd. The result was that 17 unselected daughters qualified with their first calves, averaging 7,250 lb. in 305 days. In 1948-49 six of these averaged 9,220 lb. in 305 days with second and third calves.

Cropping Based on Stock Despite the fact of turning over to milk production, I never lost sight of the need for sound constitution and good conformation. I consider that the low average life of our present-day dairy cows is due largely to the fact that they are far too "shelly" and therefore unable to stand up to the performance expected of them. Is it not a fact that one always finds longevity associated with a cow wide and strong over the loin, great depth of barrel and standing on good strong legs? Type and sustained performance go hand in hand; quality is also essential. I am firmly convinced that the most suitable cow for the majority of Welsh farmers is one that can produce between 800 and 1,000 gallons of milk with good butter fat and at the same time breed a good steer. The need for more meat is greater than ever, and with cattle such as these we can meet the needs of the nation at short notice. We farmers have just cause to be proud of our record in providing for the needs of our people in times of stress; we should see that we remain in this proud position.

Increased production calls for a higher plane of nutrition, and in 1940 I realized that efforts would have to be made to increase the stock-carrying capacity of the farm, with special emphasis on the provision of winter feed. The increasing price of milk provided an incentive for increasing the herd and for better methods of management. The cropping programme was so arranged that the area under kale and cabbage was greatly extended. It has been the practice for many years to grow alternate plots of 12 rows of kale and 8 rows of mangolds. After the mangolds are harvested in October, the cows are folded on the kale by electric fence, thus providing them with 12 rows at a time. Cabbage is fed in the cowshed. When the cows move on to a fresh plot of kale, the cabbage is reduced to a minimum, and as the plot of kale is eaten down, the cabbage is increased, thus maintaining a regular supply of green food.

In recent years, arable silage has been made from oats, peas and vetches. This crop is usually grown on the most fertile fields and undersown with grass seeds. To increase the supply of protein, about 28 lb. of beans are sown with the spring oats. In Wales we should not lose sight of the fact that our cropping ought to pivot round our livestock and plan accordingly. Only by this means can we lower costs of production and attain self-sufficiency.

The important factors of output per acre and output per man have always been foremost in my mind, and I feel strongly that no matter how well an animal may be bred, it cannot express its genetic potentiality unless the management is efficient. By careful attention to details of breeding, feeding and management in all their aspects, the average yield of the Penwenallt

herd has risen from 700 to 960 gallons. We have had disappointments but they have been more than compensated by the day-to-day interest which the work provides and in the pride of building up a good herd which is steadily progressing towards the ideal set as the target.

Bright Future for Welsh Livestock Farming I consider that there is in Wales a very bright future for livestock farming. We have some of the best cattle markets in the country, to which stock is brought from as far afield as Cumberland, and even Scotland. It is time that we ourselves improved our methods of breeding and management in order to cater for and maintain these markets. Certain prescribed areas of South Wales have now been declared "Clean Areas" under the Attested Herds Scheme. The demand for attested cattle is increasing, and it is up to us to see that our cattle are of sufficient merit to meet the demands of our customers. If we fail we shall lose our markets and, once lost, they will be difficult to regain.

I am sure that the majority of herds can increase the output per cow by 200 gallons through better management alone. We are often disappointed with the progeny of a particular bull, but it must be remembered that however good a bull may be, if used on commercial cows he has a large number of factors to correct. It must be an extremely potent sire to show a marked improvement in yield in the first generation, and we must therefore concentrate on finding a succession of good bulls to hold and extend the improvement gained.

We are not providing the maximum amount of food from our grassland. We have the climate in Wales which is suited to growing grass and we should take advantage of it. By this means we could lower our cost of production very considerably, both by improved management of grazing and by efficient conservation of the product of our grassland. Then again, there is need for greater care in the utilization of our feedingstuffs, whether home-grown or purchased.

Glancing back over my thirty years' experience of milk recording, I am certain that we cannot make much progress in the breeding of our herds without reference to milk records, nor can we feed and manage our herds without the information so provided.

Finally, we have in Carmarthen Market a section for recorded cows, and already we are finding that the prices realized by such cattle are £10 a head higher than those for non-recorded cattle. Buyers realize that with recorded cattle they have definite and reliable information whilst with non-recorded cattle it is often a matter of inaccurate and misleading guess work. This section for recorded cattle is rapidly expanding, and I feel that we should be able to offer not only good attested cattle, but that they should be recorded as well.

We have many farmers who are breeding, feeding and managing their herds very efficiently. These will provide our markets with the stock our customers need. They cannot alone, however, meet the growing demands, and there are still too many low-grade cattle being offered for sale. The demand for good stock is likely to last for many years to come and our opportunity is here now. It would be a sad day for Wales if the opportunity were lost. We have the men, the knowledge and the advice at hand. Are we allowing our opportunity to slip ?

GOOD CALVES : GOOD COWS

R. L. FAZACKERLEY

Tyn-y-Caeau, Northop, Flintshire

WE have produced milk for the past ten years at Tyn-y-Caeau, and my objective is to build a pedigree, attested, self-contained Ayrshire herd. The farm covers 113 acres, 93 of which are cultivable. Of these 93 acres, 40 are in tillage. Last year I grew 3 acres of kale, 5 acres of rape, 5 acres of potatoes, 22 acres of corn, and I made arable silage from some 5 acres of oats, rye and vetches. I also reseeded 16 acres of permanent pasture. I generally favour a four-course rotation—two white crops followed by roots, then mixed corn and a short ley—short because of the light nature of the land.

We are milking some thirty cows at the moment, and aim at rearing our own herd replacements—some twelve females a year. In addition to the milking herd, twelve in-calf heifers, twelve maiden heifers and twelve calves under one year old are kept. We have one bull for breeding, a horse, and three breeding sows. This is heavy stocking—one cow unit to 1.7 acres of cultivable land. Although I have not yet started milk recording officially, our private records show that the herd averaged 850 gallons last year.

Our system of calf rearing at Tyn-y-Caeau is similar to that adopted on many dairy farms in Flintshire. I try to have the majority of my cows and heifers calving during September and October, since I am anxious to serve heifers retained for herd replacement the following December and January—that is, when they are about 15 or 16 months old, so that they will calve down around two years. In this way it has been possible to rear groups of calves of approximately the same age and, where there is a shortage of buildings, to group calves together for rearing. Calving is done in a loose-box, and hygiene is a primary consideration, the floors and walls being thoroughly disinfected and clean bedding provided ; it is most essential to take precautions against bacterial infection at this stage.

Feeding and Management It is imperative to classify the calves in such groups as will ensure their uniform feeding and management in each. Later I divide the calves into two lots of six, according to age, and both bunches are kept separate. The calves are not suckled ; after receiving the colostrum they are taken away and kept on their own until they are strong enough to go with others in the bunch.

Liberal quantities of milk are fed to them for the first six weeks, but we introduce it gradually for the first three or four days, diluting it if necessary with ordinary water or, better still, lime water. Digestive troubles are likely to occur if a calf is given too much milk to start with. I find that even in winter, when the price of milk is higher, it is cheaper in the long run to give the calves a good start on fresh milk than to buy calf starters ; calves seem to respond better to other types of foods when they are taken off fresh milk than they do when they have been starter fed. Clean buckets are essential, and the milk should be fed when it is reasonably warm. We try to see that the calves do not drink their milk too quickly and that all necessary precautions are taken against upsetting the calf's digestion at this very important period of its life.

At about 2–3 weeks old they are encouraged to eat a little best quality hay. This is fed in racks, and it is important to keep the hay off the ground, otherwise it may easily become contaminated with germs from the bedding, etc.

I always like to make up my own calf ration and, if possible, include linseed and fishmeal with home-grown crushed oats. I find that calves reared on linseed put on a very good bloom, and the fishmeal makes for better growth of tissue and bone. About 1–1½ lb. of the dry food is offered about the fourth week and is increased gradually as cleaned up. Young calves should also be encouraged both to eat some green food as soon as they will take it and to drink water—but only good, clean water should be offered. (It is essential, too, to give in-calf heifers and in-calf cows plenty of green food for the nourishment of the unborn calf.) Minerals are fed as a supplement, and a trough of clean water is put in the pen when the calves are about a month old.

When about 12 weeks old the calves are turned out every day in the yard to drink water, and in this way they get the exercise they need. Far too many of our dairy cows are reared in poorly ventilated and inadequately lighted buildings. There should be adequate ventilation but no draughts. The floors should be good (concrete preferably) and the bedding clean. Some people, of course, use rammed chalk floors, and sleepers are used on a number of calf-rearing farms. A large number of farmers are now fitting and reconstructing their buildings with the object of becoming attested and producing T.T. milk. This is the time therefore, I suggest, when they should be thinking about including suitable calving and isolation boxes ; individual boxes or cubicles are the ideal.

The calves are turned out during the following July on to a good young ley. They are introduced to this new way of life gradually during the first week, but thereafter they are left out on grass altogether. I see to it that they do not go out before ten o'clock in the morning and that they come in at about four o'clock in the afternoon. It is a cardinal principle that any new system of calf rearing should be introduced gradually, so that the calf has a fair opportunity of adjusting itself.

Indoor feeding is not practised until the weather and the shortage of grass warrant it. Yearling cattle require some hay, oat straw and some green food, and during this store period it is very important that the calves are not allowed to lose condition. Without overdoing it, I believe that the use of roots, oat straw and hay gives deeper bodies and wider-sprung ribs to young cattle, which in turn produces deep-barrelled heifers and cows later on. Indeed if we are going to make greater use of our home-grown foods we must get a bigger, deeper-barrelled cow.

Last year I made silage and replaced roots with it for my yearling heifers. The year before I gave them a little cake, but if the silage is of good quality, I think the cake can be dispensed with. I have no set time for starting this autumn feeding of yearling stock ; it depends entirely on the weather. I grow rape for the autumn and early winter feeding of my cows and young stock. It is an excellent crop for milk production, and I advocate its use wherever possible.

The heifers are bulled during December and January and it is usually my practice to run a young bull out with them on the pasture. The udders of

all in-calf heifers are examined daily, since much summer mastitis can be avoided if the condition is detected at the beginning.

In-calf heifers are brought in about a fortnight before calving and steamed up. They are handled as much as possible during these two weeks so that they become accustomed to our routine and then settle down to their job of producing milk. This preparation of the heifer for her primary job in life is, I think, very important.

The Cows of Tomorrow We shall in future have to pay far greater attention to the problems of calf rearing than we have done in the past. If we are going to improve the general quality of our cattle we must rear our calves well, so that they will be healthy, well grown and able to convert feedingstuffs—especially an increasing quantity of home-grown feedingstuffs—into milk economically. There is perhaps a tendency nowadays to lay too much emphasis on the actual number of churns we can place on the stand, with the result that our young calves, which are to be the cows of tomorrow, are not reared on that initial high plane of management which is so essential if they are going to grow into good, healthy heifers. Where attested herds are to be established it is absolutely essential that we do our own rearing, since it is impossible to maintain a herd free of tuberculosis unless it is self-contained.

GRASSLAND PRACTICE IN THE UNITED STATES

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IN the spring of 1950 the United States was a country of surplus agricultural production over a wide field. There were large surpluses of maize, wheat, potatoes, pigmeat, eggs and a variety of other products. This created new problems, and the whole economy stood in sharp contrast to our own, where every extra pound of food produced from the land of Britain meant the saving of imports and of dollars.

The agriculture of the United States is based upon high output per man, for the reason that labour is very expensive and land is plentiful. This contrasts sharply with the outlook, say, in Holland, where land is scarce and labour more plentiful. The United Kingdom stands in an intermediate position, for we demand high output per man and per acre.

While surplus production continues in the United States it is clear that some land must go out of arable cultivation. As has happened before, this land will become derelict and regrowth of woodland and forest will follow unless precautions are taken to ensure the contrary. A similar sequence of land dereliction went on in Britain between 1880 and 1940, when more and more of our acres went down to permanent pasture, most of which deteriorated and produced less and less as the years went on. The United States advisory service is trying to bring home the fact that land not now wanted for arable cropping should be seeded down to high-quality clover pastures which can be grazed by livestock. This, of course, is one method of reducing

the total starch equivalent available for direct human needs. Indeed, if America could find means of increasing quickly its population of fattening cattle, the present surplus of carbohydrate food would soon disappear.

The American Outlook on Grass The American looks upon grass as a roughage. This outlook is in sharp contrast with our own. We regard grass as a high quality food for livestock and the basis of the production ration. In the northern American states in particular, the philosophy of grass as a crop is just beginning to take shape. Grassland is looked upon as the means of providing roughages (chiefly as hay) for the winter, and air and exercise during the summer. This view is rapidly changing, however, among leading farmers and technical men. The maintenance of a good cover of grass at midsummer is greatly emphasized ; there is almost a horror of grazing too hard during the spring flush, since this might result in a failure to provide an abundant cover of grass in the dry, hot weather of July and August. Experiments in progress in Wisconsin, for example, indicate that there is some basis for this view.

The divergence of opinion and of viewpoint between the United States and ourselves is not, however, so wide as would seem at first. We tend to graze our grass much closer during the spring and early summer, but our summer temperatures are not as high as theirs. On the other hand, a safe way to produce an abundance of leafy grass in July and August in the eastern half of England is to provide the good ley with a long rest period in June after stem production is completed. The American philosophy, therefore, may have some application in England, especially in years of acute summer drought. But the present-day American method of undergrazing all the pasture fields in the flush of spring, so as to induce a cover of stemmy material after midsummer, is wasteful and induces pasture deterioration.

The American practice is to supplement grass, in whatever form it is fed, with concentrates, as was the custom in Britain between 1920 and 1940. Grass is regarded as providing part only of the maintenance ration, and production is obtained from the feeding of concentrates. The average American farmer has not yet realized that well-managed grass is his cheapest and best cattle food. We are therefore ahead of the American in this respect, and it is likely that our lead will, in time, be followed in America, when they come to recognize that the dry matter of high-quality leafy grass is the equivalent of a concentrated foodstuff.

Like ourselves, America is faced with problems arising from a large acreage put up for hay. A vast amount of silage, too, is made, but this is based largely on the maize crop, although some silage is made from grass. Quality is not stressed and most of the grass ensiled is harvested at the hay stage. It is mostly chopped before it goes into the silo, so that very little pit silage is made. Silage-making is highly mechanized and there is as little man-handling as possible. We could emulate this with advantage, even if it means adding still more to capital invested in machinery.

One interesting development in the United States is the use of the glass-lined tower silo. Its success is said to depend on its being airtight and on the development of a carbon dioxide atmosphere, which ensures proper conservation. This silo has a motor and agitator with endless belt. The silage can thereby be fed straight from silo to cattle byres without handling.

This results in a complete saving of labour, for the silo is filled from the cutter-blower or other forage harvester, and there is no handling of the ensiled product when fed.

Hay, as commonly made in the United States, is not of high quality and is indeed little better than roughage. Haymaking, too, has been highly mechanized and current investigations into the handling of the crop in the field will tend to carry mechanization still further. The hay crusher now being evolved as the result of research at Madison (Wis.) seems destined to prove an important feature of haymaking. Hay which has been through the crushers (fixed behind the cutter-bar) wilts and dries much more rapidly than hay left in the swath. The combination of the hay crusher and the barn ("mow") drying of hay, makes it possible to cut, crush, bale and place in the "mow" drier under cover, all within the twenty-four hours. This is a new technique, the development of which we in this country must watch. American experience suggests that the adoption of these rapid haymaking methods would result in a product of better quality.

Production of Pedigree Seeds America is breaking new ground in the production of pedigree herbage seeds in commercial quantities and particularly in the case of the legumes (lucerne and white clover). The scheme is comparatively simple. Approved stocks of seed, based usually on bred strains, are once grown to produce foundation seed under the direct supervision of the breeder himself. Foundation seed is then controlled by the United States Department of Agriculture and is usually sent to California, or elsewhere with a similar climate, for growing on in commercial quantities. Thus material bred, say, in Wisconsin or New York State, will be grown in that state up to the point when foundation seed is produced. This seed is then grown in areas (such as those under irrigation in California or Arizona) known by experience to provide first-class conditions for seed production. The seed so produced will be known as certified seed and will be returned to the state where it was bred for sale to the consuming farmer. The advantage of all this is that seed is multiplied very rapidly: for whereas in, say, the State of New York, lucerne will produce 1–2 cwt per acre of seed, the same strain grown from seed in California may produce 10–15 cwt per acre of seed. Yields of as much as 25 cwt of seed per acre have been recorded in California. Added to this there is a Federal-wide system of certification, which means that the consuming farmer is assured of a fully certified product in good supply. It means, also, that new and improved strains of herbage seeds get into common use in the shortest possible time.

The breeders' stock and the foundation stocks are inspected and controlled by the plant breeding station or its designate. In the growing on of the seed to produce certified seed, the various processes of inspection, bagging, cleaning and final tagging are carried out by non-technical labour. This labour, however, will have been specially trained for the particular job of field inspections, labelling and sealing of the seed. The work may be entrusted to the local schoolmaster, or the village parson, leading farmer or even a student on vacation. None of these need to be highly trained, except in the one job of inspection and certification. This may seem to us to leave undesirable loopholes, but the scheme works effectively, is cheap, and produces the goods. We should therefore learn all we can from it.

Another aspect of seed production which came to notice in California, is the damage which normal harvesting machinery can do to the seed crop.

It has been noted in California that large annual losses occur in seed through ill-adjustment of the seed harvesting machines. Some of this damage can be detected quickly, but the more serious examples can be detected only by microscopic examination and germination test. In California, in the 1948 harvest, it was calculated that as much as 27 per cent of all lucerne seed harvested in that state was damaged during harvest and as a consequence would never germinate. The figure in 1949 was 16 per cent. By more careful adjustment of the harvesting machine, these losses were reduced to less than 6 per cent.

California produces between four and six million pounds of lucerne seed annually. In 1949 the production was thirteen million pounds of lucerne seed, of which one million pounds represented seed of the three approved strains, Ranger, Buffalo, and Atlantic. None of these varieties is adapted locally in California for the production of forage, but still they are capable of growing first-class seed crops there.

In many parts of the United States weed control, especially on the newly sown ley, is receiving much attention. Various herbicides are used, and these include diesel oil fortified with diluted secondary butyl phenol. Some of the control measures used are most effective, particularly in the control of annual weeds in lucerne. This is a matter in which we in Britain are bound to be interested as our area under lucerne increases.

New Strains of Grasses and Clovers American breeders have made important strides in the breeding of lucerne and have based much of their programme on breeding for the physiological characters of disease resistance and winter hardiness. The two varieties of lucerne, Ranger and Buffalo, are both highly resistant to Bacterial Wilt. This is a disease of which we know little in Europe, but in America it will devastate the lucerne stand once the disease has developed in it.

The success of Ladino white clover over a large part of the United States has to be seen to be believed. The breeding programmes in connection with this type are as yet in their preliminary stages, although a number of approved stocks have been built up and are being grown extensively under certification. Many of these lots are being tried out at the Grassland Research Station and elsewhere in this country. Our tests in Britain so far have not suggested that Ladino white clover does as well here as in the United States, and certainly it is not as productive nor as persistent here as is S.100 or New Zealand white. We should, however, continue with our tests on Ladino, for this type has features such as rapid development and early spring growth, which might with advantage be incorporated into our own strains of white clover. We must also seek to ascertain why Ladino does not do as well here as it does over a very wide range of climate in America. Is this difference in behaviour connected with disease resistance under American conditions and relative susceptibility here, or is it due to our systems of pasture management, or again, is the difference purely a matter of climate ?

Among other species which the Americans have found of particular usefulness are tall fescue, *Bromus inermis*, and the birdsfoot trefoils (*Lotus* sp.). We, too, may find these useful. Tall fescue under the name of alta-fescue (also Ky 31), is grown extensively in North America. In districts where winter grazing is possible, tall fescue is impressive, for it remains

green and palatable throughout. We are also interested from this same viewpoint, for some strains of tall fescue are productive in autumn and the leafage remains green and seemingly palatable well into the winter months. These developments are of interest particularly in respect of any new strains developed within the species.

Bromus inermis has been included in trials undertaken at Stratford-on-Avon and by the National Agricultural Advisory Service. So far it has not shown promise and, though productive in a normal summer, the American strains tested here tend to become frosted very early in the autumn. We should continue trials with this species, for it may well prove a useful additional species, especially in drought. Birdsfoot trefoil does well on certain very acid soils in hilly districts of New York and other eastern states under conditions too severe for the growth of white clover. We should follow the American experiences with interest, especially in relation to the improvement of our hill and marginal lands.

The Ley and Soil Fertility Critical evidence on the relation of the ley to soil fertility is as lacking in the United States, as it is with us. Yet there is a whole mass of evidence based on empirical studies which leave no doubt that the grass-legume ley is the pivotal crop in relation to soil improvement. There was an excellent example of this at the Federal Research Farm at Beltsville, Maryland, where an area in continued arable cropping appeared to be without structure and completely dead and inactive. On the same field was a newly ploughed (April, 1950) strip of land which had been under a lucerne/red fescue ley for five years. The difference in the two soils was remarkable, that under the ley being a deep chocolate brown, full of root fibre, and with a good "crumb" structure. It was difficult to believe that it had ever been in the grey, inactive condition of the adjacent arable strip. Clearly, when a good ley is ploughed under, it provides a more easily workable soil and one on which heavier arable crops can be grown. Right through the cotton lands of North Carolina, too, the ley based largely on Ladino white clover with cocksfoot and tall fescue, is building up anew the soils on the very sites where cotton and other crops had promoted soil dereliction, erosion and exhaustion.

The Americans are making use of the aeroplane for reseeding and manuring, particularly on range lands in the Far West and on sites that would otherwise be inaccessible. New Zealand has, of course, done much the same. We should keep watch on these developments and follow up with detailed experiment, especially in regard to the reclamation of hill lands. Preliminary tests were carried out on certain sites in Wales during 1950. These showed some promise and will be followed by further trials.

The Americans, like ourselves, are seeking for accurate means of evaluating the grazing crop so as to place a more reliable figure upon the real value of grass. The chemist and the agronomist seem to be on the point of providing techniques which may give us far greater reliability than hitherto. In this respect the United States seem to be no further advanced than we are, but it is clear that in this field it will be of enormous mutual benefit if American and British workers collaborate as closely as geographical limitations allow.

Dr. Davies went to the U.S.A. last year on a Technical Assistance Mission sponsored by the Ministry and by the Economic Co-operation Administration of the United States. The object of his tour was the study of American grassland techniques.

MANGOLDS

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AT Leeds recently, the Minister asked farmers "to try to increase the number and quality of their meat-producing animals, particularly cattle and sheep which can thrive on grass and other home-produced foods". There is no doubt that much grassland can be improved to support and fatten more cattle and sheep. Grass and seed products can also contribute much to the nutritional needs of our animals in winter. But farmers are also required "to grow more and better grass on less grassland," so that tillage may be fully maintained or, if possible, increased. Tillage crops are needed both for humans and animals. The aim, therefore, will have to be the utmost production from every acre with the emphasis on those crops which are capable of yielding the greatest output of foodstuffs per acre. In this connection mangolds should not be overlooked. According to the late Professor T. B. Wood, who made a special study of this crop, their dry matter has approximately the following composition :

	percentage	
Crude protein	8	
Oil	1	
Carbohydrates	80	(including sugar 60%)
Fibre	6	
Ash	5	
	100	

"This," he said, "makes it evident that mangolds are really a most digestible and productive food. They are certainly bulky because of their high percentage of water (87–89 per cent) but this is not a disadvantage in winter feeding."

The paramount reason for the decline of mangold cultivation lies in our neglect to exploit the exceptional productive potential of this crop. It appears to have been introduced into this country from the Continent by Thomas Boothby Parkins in 1786. By the middle of the nineteenth century it had assumed a very important place in the farm rotations of the southern and midland counties. Then, as now, Globes and Long Reds seem to have been the most productive varieties, the former being preferred for the shallower and heavier soils, and the latter for medium or deeper soils. Deep tillage and the incorporation of large quantities of farmyard manure were considered essential. "To all descriptions of manure used for this crop, whether home-made or artificial," says a writer, "the addition of chloride of sodium (common salt) is followed by most beneficial results." A typical manurial dressing was 20 tons of dung, 1 cwt. Peruvian guano and 6 cwt. of salt, per acre. In 1854, in a variety trial at the Royal Agricultural College, Cirencester (where in more recent times I have heard the mangold described as "the root of all evil!"), Long Red is reported to have yielded 49 tons per acre. In 1859, 64 tons per acre seem to have been grown at Rainham, 63 tons at Wroxton Abbey, and 67 tons at Eynsham. I myself secured over 100 tons on 2 acres in 1950. There are, of course, records of even greater

yields, including one of over 170 tons per acre on a broken-up cow paddock in New Zealand, vouched for by Lord Bledisloe.

The chief rival of mangolds today, is silage. This, however, requires many acres and more than one tractor and buckrake if, in addition to satisfying dairy cows, silage is to supply the needs of a large number of meat-producing animals the country so badly wants. Mangolds are capable of producing far more foodstuff per acre than is silage ; and if used with straw for carrying animals through the winter, grass which otherwise would have to be ensiled for wintering, will be set free for its natural and most economical use—namely, summer grazing.

For winter feeding kale and mangolds are complementary. Mangolds follow kale at the time of their greatest feeding value and when kale has lost its relish. Most animals of all ages and classes can deal with mangolds whole. Hence, like kale, they can be fed conveniently out of doors. These two crops respond so generously to good cultivation and liberal manuring that on most farms a few acres of each will usually suffice. Moreover, the work involved is commonly within the compass of the regular farm staff. With Globe mangolds, lifting can be expedited by leaving the tops on (when they have drooped perceptibly) and pushing them out with a heavy wedge-shaped plough steadied behind by a central disc wheel.

For a maximum crop of mangolds we need to revert to the ways of our predecessors : deep autumn ploughing incorporating a heavy dressing of dung or, as many preferred, manuring the preceding crop heavily, so allowing the mangold to range through the richly charged soil and find its food ingredients in a more assimilable form. (We achieve the same objective and save labour by allocating to mangolds and kale a convenient small field near the farm buildings for continuous cropping in alternate sections.) Cross-ploughing was avoided wherever possible, and the crop was sown early in April on a frost tilth. Whatever fertilizer or combination of fertilizers was used, experiments of those days showed that the addition of salt was beneficial " especially on soils of a dry character". Faith in salt was fortified by learning from analyses that the ash of mangolds contained more salt than any other chemical substance. It was obvious, too, that for full development the mangold required much moisture, hence the deep, finely disintegrated tilth and the abundant supply of organic matter. Among observations recorded was the occasional blocking of drains 3 and 3½ feet deep by the rootlets of the growing crop. Then, as now, almost the only real impedient to a full crop was the characteristic irregularity of germination. Farmers in those days were just as near to solving this problem as we have been. They passed the seed through a bean-mill to break up the husk but for the most part relied on simple immersion in water for 24–48 hours previous to sowing. In my own experience I have always found that this trouble can be largely overcome by drilling quite shallow in moist soil and rolling afterwards.

In striving for the greatest possible measure of self-sufficiency we need not necessarily strive also for originality. T. B. Wood's experiments recorded in the *Journal of the Board of Agriculture* showed that a ration of mangolds and straw, supplemented by 1 to 1½ lb. of common cotton cake to make up for the shortage of protein, was "both economical and successful in the production of winter-fed beef." Many of us have more straw than we know what to do with. There is no real difficulty about growing mangolds, and 2 to 3 lb. of clover or lucerne hay contain as much protein as 1 to

1½ lb. of undecorticated cotton cake. Lord Keynes, generally acknowledged to have been one of the greatest men of the twentieth century, was reflecting somewhat ruefully in the maturity of his later years : " We had no respect for traditional wisdom or the restraints of custom. . . . It did not occur to us to respect the extraordinary accomplishments of our predecessors in the ordering of life or the elaborate framework which they had devised to protect this order."

On the Continent, where fodder roots are still largely grown, there has of recent years been a marked turn-over from mangolds to fodder beet and sugar mangolds (crosses between mangolds and sugar beet). The advantages claimed for these strains are that they produce quite as much dry matter per acre, in about two-thirds of the gross weight, giving a notable economy in carting, and they can be lifted by the same types of machine that are used for sugar beet. Variety trials with these crops are being laid down in Britain this year.—*Editor.*

URBAN FARMING

J. TASKER

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TO most minds the word "farming" conjures up a picture of a farmhouse compactly situated with numerous farm buildings, perhaps near a clump of trees, surrounded by arable and green fields. The vision embraces a small village or hamlet nestling in a secluded spot " far from the madding crowd," where the only " foreigners" are tradesmen from the nearest market town. Life in this imaginary community goes on serenely from morn till night, mostly on the same theme, save for certain vital periods of the year when the inhabitants are galvanized into extra effort to gather the fruits of their labour.

That, Farmer Brown, you may think is a fairly accurate, if broad, conception of farming ; but come with me on a journey to another type of farming country.

Farming among the Factories The city we have just passed through has a population of over half a million souls, very few of whom have any direct or even indirect connection with agriculture and most of whom would think of farming as being on the lines I have just described. Here we are at a dairy farm just 3½ miles from the centre of that city and still within its boundary. You'll notice that it is bounded on one side by a large brick and tile works and on another by one of the biggest steel concerns in the north, whilst a main road traverses its whole length. You see how its home pastures run right down to the factory edge. Look at those large chimney-like structures in the centre of them. They are ventilating shafts for coal mines, which means that the whole area is undermined. This is a 150-acre farm retailing 150 gallons of T.T. milk a day from 60 to 70 cows. No, the occupier is not an industrialist turned farmer, but a real son of the soil who has reached the position he is in today by sheer hard work, determination and skill. Take a look at this old pasture we are standing in,

for instance. It is a good colour, full of growth and the right kind of sward. It was cut for drying last May and the resulting analysis showed the dried material to have a protein content of 21 per cent. What do you think of that, and only 3½ miles from the centre of a large city ? Of course it is good, but do you know why ? Because the farmer believes in regular liming, and, in addition, he collects all his liquid manure in a large tank and spreads it on his grassland, and (maybe) you let all yours run to waste down the drain.

We'll walk to the top of this hill so that you can take a good look round. Notice the mixed crop for silage growing in the field on our left. To produce milk you must have protein, you know, so this man goes out to get it. Dried grass, silage and kale, which you see growing over there, are all good ways of producing it. But I really brought you up here to show you the surrounding country. Take a look. Not green fields as far as you can see, like the view from most farmers' bedroom windows, but chimneys everywhere—mill chimneys, factory chimneys, foundry chimneys and house chimneys—all belching forth acrid fumes and soot to settle on the land. What's the result? A frequent need for lime and yet more lime. The liming programme on the ordinary farm wouldn't be adequate here.

Take notice of the buildings as we walk back to the car. That large one on the left is a Danish-type piggery where household waste, collected from the city after processing, is turned into bacon. The one in the centre houses a milking parlour where the cows from the adjoining buildings are milked and whence the milk goes by pipe to the cooler and bottling room. The bottle washer and sterilizing plant are housed on the other side. Up-to-date isn't it ? It has to be, to keep pace with the times and to meet competition.

But I've shown you the best conditions first because this farm is in a ring fence. We'll go a bit farther. You'll see as we go along that there are houses, factories and other forms of industry all along the route. On the main roads you'll observe ribbon development, permitted in the past but frowned upon now by the planning authorities. There's a farm I'll show you. What's that, you can't see one ? It is there, almost shut in by houses. This was a compact holding of 70 acres not so many years ago, then land was taken for building, with the result you see. The Americans have their erosion problems ; so have we, but of a different nature. The farmhouse is in the centre of that row, with the buildings behind it. You may well ask where the land is, for apart from the paddock adjoining the buildings, it is scattered amongst various built-up areas and probably belongs to different people, which means several landlords. I agree it is well farmed, but only under great difficulties. It's as well that someone has the pluck to tackle it, otherwise it would go derelict. Remember this, that the soil here is derived from Coal Measures and Millstone Grit and is inherently poor ; yet there are thousands of men who are trying to make a living under such conditions in areas like this, and at the same time endeavouring to provide food for the nation.

The Dwindling Acres What would you feel like if some of your land was taken for a housing estate or a school site ? You would be very disheartened I'm sure. Yes, I know they've built a few workers' cottages in your village, but they put them on a piece of very moderate land adjacent to the village green where it did not interfere with anyone's farming ; and remember that it is to your advantage to have cottages built for your workers, whereas the houses built in these areas are for industrial folk. On this particular farm, the farmer has to take his cattle and implements along a

busy road to get to his fields, which all adds to the hazards and wastes time. I could show you cases where the splitting up of a holding by urbanization has rendered its farming wholly uneconomic, with the result that either the land has become accommodation land, or the farmer has had to alter his farming policy completely. The original holding had, in many cases, buildings and fixed equipment relevant to its total acreage, so you can imagine what happens when large lumps of the holding are taken from it. There are instances, too, where a housing estate has swept away the buildings altogether, leaving a parcel of land devoid of accommodation for stock or crops.

We'll travel a bit farther and see a bit more. The scenery doesn't change much, does it ? Look at this holding here which is now a market garden. The crops look very well, I agree, and don't bear out my statement about poor soil. They are not growing on the natural soil, but on what we call "made soil" ; for generations household ashes, refuse and sewage sludge have been tipped here, with the result that the growing medium bears no resemblance to the original. Here's some rhubarb ; there are thousands of acres grown in these parts. The soil and industrial conditions seem to suit it. Those long, low, black sheds down there are used for forcing.

That farm you see on the hill top is a small dairy farm. The farmer keeps a pedigree herd of attested Ayrshires. Those are his milkers in the next field. They do him credit, don't they ? Look every bit as healthy as yours. He has done a lot of reseeding to improve his pastures and thereby to increase the stock-carrying capacity of the farm. The industrial deposits on the grassland are not too good for them—they may even result in fluorine poisoning. They have to be combatted by ploughing in the sod fairly frequently, liming, adding fertilizer, and sowing afresh. Only in this way can the land and the stock be kept healthy, but it doesn't need me to tell you that this all adds to the difficulties of farming. Now look at the corn growing in the close, bordering that pit heap. Apart from its grimy appearance, it looks like yielding well. Yes, the colliery dirt stack is on fire and will burn for long enough, and unless the lime level in the soil is maintained, the crops will suffer. The farmer here has had the good sense to use plenty of lime, knowing it is the only way. It would not be any good having that field in grass ; the stock wouldn't thrive. So you see there is another limiting factor.

Talking of colliery slag heaps reminds me of two cases which may interest you. The first is where an enormous tonnage of slag has been moved from one point of the hill to another for levelling purposes in preparation of a site for a new power station. The building is now in course of erection and is actually on a portion of the slag heap, which means that non-agricultural land is being used instead of swallowing a large slice of farm land and sterilizing it for ever. The second instance is one where a little foresight has ensured that land used for colliery tipping will one day be restored to agricultural use. The top soil has been removed and kept apart before tipping was started, so that when the site has been fully covered, the soil can be returned and sown to grass. Instead of being both a waste of land and an eyesore, the area will be green and useful. With modern machinery it is not a difficult job.

Now we are in an area where urban encroachment has reached an even higher pitch than in some parts I've already shown you. What do you say ? Someone's trespassing ? Oh dear, no, he's no trespasser, he is on a footpath. Everywhere you go here there are public footpaths, sometimes as many as five or six on a farm, running in every direction. I know one farm where

a footpath runs through a stackyard and where the farmer has lost his harvest through fire two years' running. People don't keep to the recognized route ; they take short cuts. Even worse, they are sometimes careless with cigarette ends and forget to shut gates. This kind of thing is bad enough for the ordinary farmer, but for these men trying to get a living in what are now urban surroundings, it is a real headache, especially if cattle get on to these busy roads. Very different from yours getting out into the quiet lane.

Look across to your left at those prefabs. The site they occupy was a 100-acre farm not long ago. True, we must have houses, but the fact of losing a few acres here or a field or two there for building purposes increases these farmers' difficulties. The land is lost for ever, and they've either to cut down their stock or try to produce more from what is left—from soil, remember, that has a low potential to start with. No wonder they crop every nook and corner and work right up to the ever-encroaching colliery muck stacks.

You must be thinking that farming under these conditions is a constant battle of wits. It is. Because you are seeing good average crops, please don't imagine it's easy. There are many hazards with which the urban farmer has to contend. You will have noticed, for instance, many fields with football posts in them—a natural result of a thickly populated area. The young people must have recreation, and it is often the lesser of two evils to allow them to play on one of your grass fields and know where they are, than try to keep them out altogether. But it doesn't encourage grass improvement on those particular fields.

You haven't seen a single sheep yet ? No, you are not likely to. Industry and sheep don't go together. Industry needs workers, workers keep dogs, and dogs don't go well with sheep, unless they are properly trained to them like yours. You know, too, that sheep require good fences—well, fences don't last long here ; wood burns, you see. The result is that these farmers have given up trying to keep sheep. It is a great pity from the point of view of mixed grazing, because a good deal of the grass would lend itself to sheep and would benefit from them.

Producing for a Doorstep Market What, then, do you think is the outcome of the things I have shown you ? Environment governs the type of husbandry that can be adopted. Here, with a large population, there is a ready market for liquid milk and vegetables, so we have mainly dairy units and market gardens. The dairy stock is chiefly of the milk-and-feed class—flying herds, if you like. Other livestock is kept, of course, and cash crops are grown, but the emphasis is on milk. Before the war, purchased feedingstuffs formed the bulk of the material used, as you can well imagine, but the war has altered all that. These farmers have had to adapt themselves to changed conditions far more than the men in your area, and as they can no longer buy sufficient feedingstuffs, they have had to try to fill the gap from their own land. More bulk can be obtained from arable land than from grass, so in went the plough and these men are growing oats, barley, wheat, potatoes and roots, drying grass and making silage. Most of the barley, wheat and potatoes is sold, and the other crops turned into milk, bacon and eggs.

The district I have shown you is vastly different from your own—like going into a foreign country, isn't it ? There are difficulties facing the urban farmer which are not always appreciated. Level fields appeal to others as

well as the farmer, with the result that it is often the best land that is taken for building. There is another factor which creeps in : supposing you knew that 10, 20 or 30 acres of your land had been earmarked for a housing estate or a school and you would lose it in the next four years, what would your attitude be towards the land ? You wouldn't feel it worth your while to spend a lot of money on it in the form of fertilizers, but tend rather to get out of it all you could before it went. The result, as you know, would be that the productivity of the area would decrease each year, and if it happened to be several years before it was actually built on, it might well become non-productive. That is what is happening here in many instances, with consequent loss to both the farmer and the nation. In some instances it is even worse, because the land is divided into small parcels by curbing and sewering and is left uncultivated altogether. There is an instance I can quote where 400 acres were taken for urban extension and lay idle for a year as a result. Three farms were involved and have now disappeared. You can appreciate the psychological effect on these urban farmers when they see an ever-increasing population providing a larger potential market for their produce right on their doorstep, being offset by a constantly diminishing acreage from which to produce.

So at the end of our journey, and before you return to your own nice compact holding well out of sight of chimneys, let me try to sum up. The urban farmer has to face, in addition to the normal hazards of his calling, poor soil, pollution, trespass by people and dogs, disintegration of the farming area, scattered fields, constant encroachment by building, quarry working, coal mining and so forth, resulting in reduced scope. Collectively, such men as these are farming a large area of our country, and many of them are farming it well. I admire them more and more. They have very serious problems to face, and only those with a will and capacity to continue in the adverse circumstances of their environment stand any chance of success. They are gradually being squeezed into uneconomic units or out of business altogether. Urbanization has reached the point where any further advance can result only in driving more producers from the industry.

THE DEVELOPMENT OF MODERN HORTICULTURE

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THE history of commercial horticulture makes a fascinating study. It shows how, through all the years, a well-defined cycle of development and consolidation has been maintained, even in the most difficult periods, and leaves a strong impression that a new phase is now about to begin.

It is not easy to say when the old days finished and modern times began, because the new owes so much to the old. It may seem unkind to go back six hundred years to the time when the gardeners of the day " by reason of their scurrility, clamour and nuisance in selling their wares did daily disturb the priests and laymen of St. Augustin's church ". And it may seem unnecessary to come nearer by three centuries to read of the first market

buildings that were erected on the site of a certain convent garden, and to picture, wandering amongst them, an orange-seller who was perhaps the first to prove that glamour in the retail fruit trade has its value. But it is important to remember that all through these years of long ago new varieties and new crops were being brought into the country by enterprising landowners and gardeners, and inquiring minds were pursuing and recording the developments, paving the way for men like Thomas Andrew Knight and all those who followed his methods to give us varieties that have stood for more than a hundred years, and in some cases are still in commercial production today.

Growth Stimulated by Industrial Expansion

Perhaps then it was about 150 years ago that modern horticulture began. The times were favourable: the age of manufacture and transport was dawning, new towns were springing up and old ones were expanding, population was increasing, and vast social changes were beginning.

Many of the great advances made during the first half of the nineteenth century maintain their influence today. The scientific breeding of new varieties of fruit and vegetables had commenced, the tomato was struggling for favour, though with little success, the glass-frame and hot-bed had evolved from a curious medley of protective devices into something almost approaching standardization, and glass structures heated by flues or even hot water, had begun to make their appearance as the commercial counterpart of the ornate orangery without which no fashionable gentleman's residence had previously been considered complete. The truth was, the age of specialization had begun, born of the new wealth that demanded better and out-of-season produce or craved something new, like great bunches of cut flowers to replace the traditional posy or the shrub or plant in a tub.

By the middle of the century, the wagons bringing the produce to the towns were almost lost among the ever-growing stream of other wagons lumbering in with timber and bricks for more and more building. Around London, Chelsea could no longer pride itself on its orchards, Vauxhall on its market gardens, or Battersea on its famous asparagus. Horticulture was moving to new land, farther and farther away, and though the move entailed all the difficulties of a new start in a fresh area, it also conferred the benefits of virgin soil. And in the mews behind the Victorian squares were abundant supplies of manure for those who cared to cart it away. It was as though the industry was starting again, and under such conditions development naturally flourished, guided by men whose names are still mentioned today wherever horticulture is discussed, for many of the crops we grow or the methods and equipment we use, owe their origin to the inventiveness of these early scientists.

The second half of the nineteenth century might well be called the "Age of Glass," and must ever be associated with the influence of Paxton and his great Lily House at Chatsworth—the pattern for that even greater glass house, which was also designed by the famous horticulturist, and will be remembered in the Festival of Britain.

The Worthing area led the field and gave us the first "structure" and the first house on wheels. But North London was almost level, though soon the demand for building proved too strong and drove the glass farther away to the valley of a river called the Lea. And as the century moved to its close, the outer areas of Middlesex and the North Kent and Blackpool districts

Covent Garden Market—1780

Photo: *The Grower*

Covent Garden Market—today

Selected produce – 1920

Photo: National Farmers' Union

Selected produce – 1950

A block of modern glasshouses constructed of light alloy

Photo: Boulton Overhead Irrigation Ltd

The general adoption of irrigation might well do more than any other one thing to even out production from year to year

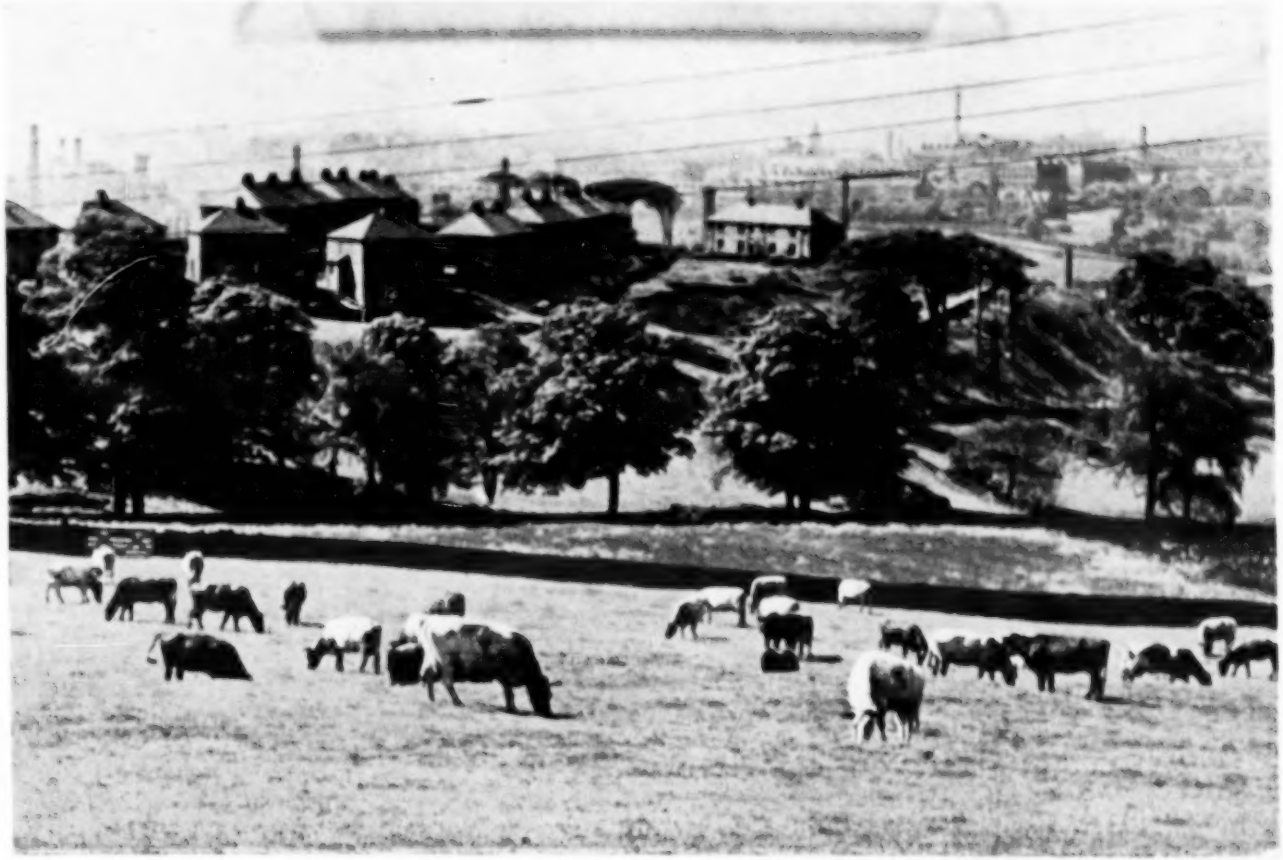

Photo: H. J. Moore

Where town and country meet. A West Riding example of urban farming described by Mr. J. Tasker on pp. 569-73

had to help satisfy the growing demands for the previously despised tomato, of which today we consume as much as 350,000 tons a year.

In this period, too, came the first commercial application of the principles of scientific plant breeding. Firms whose names are known and respected throughout the whole of the industry began to produce varieties of fruit and vegetables, flowers and plants, which still satisfy the demands of a discerning market or capture prizes at the leading shows. Only the flower trade failed to gain further advantage. Cut flowers and flowers in pots made little headway against the increasing concentration of soot and smoke which favoured the monumental fern and aspidistra.

When the present century dawned the demand for building land did not slacken. People began to live farther out of their towns as the suburban railways and electric tramways were extended and the wealthy bought one of the new automobiles—very prudently retaining their horses for those days when the engine wouldn't start !

Then the engines began to start regularly, and as horticulture was pushed farther away, there was less and less manure for fertilizing the new land. And the imports of fruit and vegetables which in earlier years had come spasmodically, began to mount steadily, and very naturally to consist of the best quality the foreign grower could produce.

In these circumstances, the leading home producers became more anxious to improve the quality and packing of their own produce and above all to obtain more regular yields. Average production had previously been very variable and comparatively low, due generally to the not infrequent crop failures which for many years had been assigned to " the Blight," a convenient term long used to cover all kinds of pests and diseases, and even frost.

Promotion by Scientific Research

It was then that research, as we understand the word today, came into its rightful place. A modest though uncoordinated start had already been made, and on that, those early research workers whose names will always be remembered, built the present structure with the support and interest of all progressive growers and all the governments of the times. Helped by the progress and research of other industries, the first half of the twentieth century has seen a true scientific advance in horticulture ; pests and diseases have been more completely controlled, machinery and equipment have been improved and invented, and storage and processing have been developed. Yields have been increased and new crops, new forms of production, and new methods of market presentation have been introduced. In spite of the difficulties of two world wars and the economic problems that have followed them, production, aided by research, is today less affected by natural forces than was the case years ago.

Statistics have now been collected for a sufficiently long period to show that average yields of both fruit and vegetables have not only increased but have become much steadier. This is due to better management, the adoption of scientific methods, improved varieties and better siting. But the annual variations still persist and may generally be explained by referring to the weather reports or studying the records of the incidence of pests and diseases for the year. And it may be seen that whereas frost, disease or pest may seriously affect the yield of one crop or one well-defined group of crops, drought may affect several groups of crops and extend its effects into the

following season. It is clear, too, that a comparatively short drought, provided it occurs at a critical period, may be as disastrous as one that is prolonged throughout the height of summer.

The general adoption of irrigation might well do more than any other one thing to even out production from year to year and avoid the extremes of supply and prices which too often give rise to an unbalanced acreage the following year, and upset consumer demand. It is known that artificial water supplies not only assist growth, improve quality and mitigate the affects of pests and diseases, but there is strong evidence that under certain conditions damage by frost may also be reduced. However, much research and trial have yet to be done before the best methods of use can be determined with certainty.

The further development of storage and processing will be the other major factor likely to promote greater continuity in market supplies, maintain and encourage consumer demand, and prevent the wastage of high quality produce. Compared with twenty or even ten years ago, great expansions and improvements have already taken place, and further advances can confidently be expected. The perfection of the ability to hold soft fruits and green vegetables in their fresh raw state for short or intermediate periods with no quick deterioration when they are taken out of store will perhaps be the greatest achievement in this field.

But although it is true that all forms of preservation can do much to even out supplies to the consumer, and in this way help to counteract the inequalities of seasonal production, it has to be remembered that the processing industry must rely upon guaranteed, regular supplies of raw materials. It cannot live on the surplus of bumper years, since to do so means an irregular and therefore highly uneconomic use of storage capacity and other capital equipment. Supplies must be available every year, even when crops are light. And although in some cases, processing offers an outlet for second quality produce, e.g., for certain fruit juices or fruit-flavoured ices, in others, particularly freezing, it must have the best quality only.

Regular Supply and the Consumer Whether production is designed for the fresh market, for storing or for processing, greater regularity in output will inevitably be the aim of the grower. And although the ideal of a constant annual production is still a considerable distance away—and indeed may never be reached—it is almost certain that irrigation, storing and processing will be the next steps towards the goal and the main features of the next phase in the development of horticulture. Used together properly, they seem capable of reducing the present scale of variation in output, of avoiding much of the wastage which now occurs in good growing years when quality is invariably high and costs of production low, of providing the consumer with more regular supplies of better quality produce and of stabilizing prices at all stages of sale. Development along these lines may well occupy the whole of the rest of this century.

It is often contended, however, that although greater regularity in output and greater availability of supplies in the form of more stored and processed products would undoubtedly be to the benefit of the consumer, they would not necessarily lead to more lasting economic prosperity in the producing industry. Many growers maintain that they are able to remain in business owing to the fact that whilst in most years profits are low or even non-existent on the majority of crops, they generally get a sufficiently handsome

return from a few to provide a small balance over the whole holding. In other words, they would hesitate to exchange the ups and downs of the roundabouts and swings for the narrower, though more regular, takings of the shooting gallery. It is also said that increased sales of stored or processed fruit and vegetables will automatically reduce the sales of the same commodities in the fresh, raw state. But there is very little evidence to support either of these views.

There is no reason to believe that the peak of total demand has yet been reached. In the first half of this century when other foods were freely available, the apparent consumption of fruit and vegetables as a group rose steadily, though there were changes in the rates for individual commodities from time to time. For example, the consumption of apples rose quickly during the early years and then remained fairly constant from 1924 to 1938, during which period other fruits, particularly oranges and bananas, showed substantial and steady increases. The same sort of thing occurred in vegetables, with tomatoes increasing progressively over the whole period, their consumption in 1934–38 being roughly double the average of that in 1909–13. Cauliflowers and early vegetables also increased and no kind suffered a decline in demand.

Throughout this period total supplies from both home and foreign sources rose steadily and the home grower first maintained, and then began to increase, his share of the total. By 1914 imports of fruit were averaging more than 700,000 tons, and of vegetables nearly 300,000 tons ; in the five years 1934–38 the averages were more than 1¼ million tons of fruit and nearly half a million tons of vegetables, but over all these years home sources provided more than one-fifth of the total supplies of fruit and four-fifths of the total supplies of vegetables.

Examination of the annual imports that make up the averages quoted above shows that about 70 per cent of the combined total consisted of produce which cannot be grown in this country (bananas, oranges, etc.) or was imported well outside the home season, e.g., winter tomatoes, and that in general the imports varied in inverse proportion to the home crop, indicating that consumer demand ruled at a fairly constant level from year to year. And in those years when the home crop was short and additional foreign supplies were required, the deficiency was not always made good by the same commodity ; a shortage in our apple crop was not wholly filled by apples but by extra bananas and oranges, and a scarcity of green vegetables in winter was often made up by the increased imports of carrots. This steadiness in demand for fruit and vegetables as a whole is of the greatest importance to horticulture and may well hold the key to future development.

There is no evidence that total demand had reached its peak in 1939, and since then it has become plain that the more even spread of purchasing power enables more people to buy fruit and vegetables, while the nutritionists have said that the pre-war consumption of fruit should be increased by 70 per cent and of vegetables by 60 per cent if everyone is to have an ideal diet. Moreover the population has gone up by 7 per cent, a proportion that can more than absorb the average post-war increase of about ¼ million tons in our total supplies.

An All-the-year-round Market The main conclusion, therefore, must be that we are very far from reaching the optimum level of consumption, and there should be room for increasing supplies

The rate of increase is unlikely to be spectacular ; it is much more probable that it will follow the steady rise which was the chief feature of the early years of the century, and there is therefore, unlikely to be any great or sudden change in the producing industry. The development must be gradual but it must also recognize that the consumer is the one who alone can point the way, and that no business can expect to enjoy prosperity if it does not take notice of what its customers require. And the requirement here is a regular all-the-year-round supply of a wide choice of fruit and vegetables at reasonable and—what is perhaps more important—steady prices. It must also be accepted that as long as this requirement is satisfied very few customers will worry much about where the produce comes from, but will instead be much more concerned with getting full value for their money and will pay more and more attention to appearance, quality and condition.

If, therefore, the home industry is to maintain or as it did in the years before the war, increase its share of total supplies, it must take full notice of the consumers' desires. It must produce more regularly and, by growing specifically for the different outlets, the fresh market, the store or the factory, aim at having quality products available in one form or another all the year round.

To achieve this object it will become necessary to pay as much attention to the utilization and marketing of a crop as to its production, and the closest co-operation between growers, packers, storers and processors will be essential.

LETTUCE MOSAIC IN THE FIELD

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FAILURE to heart is common with outdoor lettuce ; plants are often small and have yellowish, mottled leaves, which are usually crinkled and stiff, and sometimes scorched. This condition is widely, but erroneously, considered to be caused by adverse weather or soil, or by insect damage, although it has been recognized in Britain as the result of infection with Lettuce Mosaic virus since 1931(1).

The disease has been reported from most parts of Britain, but it is especially important in the south. Losses of one-quarter of the crop are common, and occasionally entire crops are rendered unmarketable. Its prevalence varies greatly in different years, from one locality to another, and even from field to field on the same farm. It was exceptionally prevalent in 1935, 1944, 1948, 1949 and 1950, whereas it was relatively unimportant in 1936, 1937, 1943 and 1947(2). Plants infected when small are affected more severely than plants that are well developed, and because of the long period winter crops are in the field, they usually suffer greater loss than summer crops.

The virus does not persist in the soil, but is carried by lettuce seed. It is spread by aphids, that feed first on infected plants and then on healthy ones ; and the initial sources of virus for a crop are either seedlings from infected seed or nearby infected plants, usually other lettuce crops.

LETTUCE MOSAIC IN THE FIELD

Seed Infection Lettuce Mosaic is one of the few viruses which are regularly transmitted by seed. Infected plants set fewer seeds than healthy ones, and up to 15 per cent of the viable seed set by infected plants may give rise to diseased plants. With the exception of the variety Cheshunt Early Giant, which always gave healthy plants, germination tests at Rothamsted with samples of commercial seed have usually given 1–4 per cent infected seedlings (3), suggesting that Mosaic is very prevalent in seed-growers' crops.

The plants produced from infected seed are small and valueless, but the loss of crop because of them is relatively small. Their importance is that they provide sources of the virus scattered throughout the crop, from which spread can occur to nearby healthy plants. The extent of spread will depend on the numbers of aphids that infest the crop and the frequency with which they move. These factors in turn depend largely on weather, which explains the variation in prevalence in different years. In fields kept under observation in the Thames Valley, Buckinghamshire, crops with 1 per cent plants initially infected because of seed-borne virus, have had by harvest from 3 per cent to 40 per cent infected plants, depending on the course of aphid infestation. In given conditions the number of plants infected from each initial source of the virus will be approximately the same, so the extent to which seed is infected greatly affects the incidence at harvest. The difference between 0.2 per cent and 2 per cent infected seed seems small, but if the disease increases thirty-fold during the life of the crop, the first will have only 6 per cent plants infected at harvest, and the second about 60 per cent.

Aphids infesting Lettuce Not all the aphids that infest lettuce spread Mosaic; of those that do, some are more likely to cause infections than others. Three species are commonly found on lettuce :

1. Lettuce aphid (*Nasonovia ribis-nigri* (Mosley)),
2. Potato aphid (*Macrosiphum euphorbiae* (Thomas)), and
3. Peach-potato aphid (*Myzus persicae* (Sulzer)).

Other aphids occur so rarely that they can be of little economic importance. Ainsworth and Ogilvie (4) found the potato aphid to be commonest on lettuce in the south-west of England during their investigations, but during 1947–50 in Buckinghamshire the lettuce aphid was most numerous (5) ; it overwinters in the adult insect stage on lettuce, but eggs are also laid on blackcurrant and related shrubs. As growers know to their cost, the lettuce aphid feeds on the inner leaves of the plants, often making them unfit for sale, but tests have shown that it is not a vector of Lettuce Mosaic virus (3,4).

Both the other aphids carry the virus, and both feed on the outer leaves of the plants. In the south-east of England the potato aphid is sometimes as numerous as the lettuce aphid, especially during the winter ; it is a relatively inefficient virus vector, compared with the peach-potato aphid, which is rarely numerous, but is present on lettuce in sufficient numbers to account, with the potato aphid, for the virus spread which occurs.

Variation in aphid infestation is great, both in time and place, but the general picture in south-east England is as follows : many potato aphids, and smaller numbers of lettuce aphids and peach-potato aphids overwinter on the lettuce plants. Winged forms are produced throughout the winter, but as aphids do not fly at temperatures below 54°F., there is little or no movement until early April. In spring, coincident with the renewed growth

of the lettuce plants, the aphid populations increase rapidly. Winged individuals migrate to the spring crops planted from frames, and to the early drilled lettuce ; very large populations, especially of the lettuce aphid, develop on these crops during April and May, many winged aphids being produced during these months. Predators and parasites of the aphids usually take a heavy toll during the summer, and possibly the heat from the soil surface in sunny weather is detrimental ; but whatever the causes, aphids are usually scarce on lettuce during late June, July and August. During late September and October the aphids increase in number again on the autumn and winter crops.

Most of the virus spread is by winged aphids ; these need not have been bred on the lettuce crops, for vector aphids can pick up the virus from the diseased plant in a few minutes, and they acquire it more readily after a period of starvation, such as during flight. Aphids cease to be infective within a few hours, but within this time, if they feed on a number of plants, they may infect more than the first plant upon which they feed. However, the chances of additional infections decrease with an increase in frequency of feeding.

There were two main migration periods of the peach-potato aphid in Buckinghamshire during 1947–50, April–June and October (3). Many of the aphids probably came from crops other than lettuce, especially in October, for this aphid breeds on the various brassicas, turnips, beets, spinach, potatoes and numerous other cultivated plants and weeds, so that there is a constant supply of host plants available in market-garden areas. The potato aphid, the other vector, also overwintered on spinach, and was common on potatoes during the summer. In many parts of Britain there are large migrations of these two aphids from potatoes and other crops in July.

The peach-potato aphid was the principal virus vector in the field, as well as being the most efficient in the laboratory ; this conclusion was reached after the aphid records had been studied in relation to the amount of spread of Lettuce Mosaic virus throughout the three years.

Spread of Virus from Crop to Crop

Two types of virus spread could be recognized in Buckinghamshire, that from seed-borne sources within the crop, and that from an infected crop to another nearby crop. Winter lettuce was usually infected, often so badly that none was harvested and the whole crop was later ploughed in. These plants were usually not destroyed, however, until many of the aphids bred on them had developed wings and migrated to the young crops planted from frames or drilled. As a result, the early spring crops suffered severely from Mosaic ; they, in turn, bred large aphid populations, as described above, the winged forms of which carried the virus to later drillings. Thus the early summer crops became badly infected. With the scarcity of aphids, later summer crops suffered less.

The belief that the virus is carried successively from one crop to another was supported by the fact that a higher concentration of diseased plants was often found in the outer rows nearest to the older infected crop. When winged aphids are colonizing a crop, they usually first infest the outside plants, even if, like the peach-potato aphid, they are active and go from plant to plant, producing a nymph here and another there, until a fairly even population is dispersed over the crop. Most of the virus being carried by these aphids will be transmitted to the first few plants on which they feed, in these circumstances to the edge plants.

Barriers to aphid flight or drift (for aphids cannot fly at wind speeds higher than 2–3 m.p.h., and are often transported involuntarily), such as trees, hedges or buildings will stop many aphids, which will then fly down to the nearest plants. Thus it is that virus infection is sometimes greater near hedgerows or other obstacles than in the open field.

Lettuce crops are often planted or drilled adjacent to, or near, older lettuce crops as land becomes clear, and under these circumstances spread of virus from one crop to another can be disastrous, for the young plants are most susceptible to infection with virus.

One grower who was co-operating in the recent work, having suffered heavy losses in previous years, agreed to omit the winter lettuce crop, thus breaking the cycle of virus infection; he then planted all the lettuce from frames in one large block at one end of the farm, and placed his first drillings in another large block as far away as possible from the planted lettuce. Both blocks became heavily infested with aphids during the spring, but little virus was introduced into them, as these aphids had not come from winter lettuce or had flown some distance and probably fed elsewhere before finding these crops. Later drillings were separated as far as possible from these first crops, and little crop-to-crop spread occurred during two seasons, whereas on other holdings in the same area some of the spring and early summer crops failed completely.

It was expected that this practice of planting in large blocks at a distance from each other would be successful, because firstly, if virus is introduced into a crop from outside, the larger the area, the smaller is the ratio of the area of the badly infected outer rows to that of the whole crop; secondly, aphids soon lose their power to transmit Lettuce Mosaic virus when they feed, even on other non-susceptible plants, and the greater the area of crucifiers or other crops intervening between lettuce crops, the greater are the chances that the aphids will feed on them. Even if they ultimately reach the other lettuce crop, most will have lost their infectivity.

Some weeds are susceptible to Lettuce Mosaic virus (e.g., groundsel and prickly sow thistle (*)); there are many reasons why land should be kept free from weeds, and this is yet another.

Control Measures The relationship between the lettuce plants, the virus and the aphids may seem rather involved, but there are a number of measures by which the disease can be reduced to negligible proportions in most years.

1. The most obvious remedy is the production of virus-free seed. With the knowledge available, there is no reason why seed producers should not provide clean seed; they should grow seed crops in isolation, and harvest from healthy plants only.
   Until good seed is generally available, growers can ensure that they use only the best by growing a few hundred seedlings before using a stock of seed in the field. With a little practice, diseased plants can be recognized after a few weeks' growth.
2. Frames in which seedlings are to overwinter should not be close to lettuce crops and should be kept free from aphids; particular care should be taken during the autumn migration, that is during October and early November.
3. Seedbeds from which winter lettuces are to be transplanted, or the drilled winter crops, should be as far from other lettuce as possible;

they should be in the open, not adjoining hedges, woods or other buildings.

4. When transplanting, lettuce should be dipped in a nicotine solution ; winter crops might with advantage be sprayed or dusted with an insecticide during late November, when the autumn aphid migration is over. Any crop which becomes badly infested with aphids at any time during the year should be sprayed or dusted with an insecticide, chosen in consultation with the Advisory Entomologists of the National Agricultural Advisory Service.
   The aphids to be attacked are those on the old diseased crops ; the spraying of a young crop with a persistent insecticide to protect it against infection with virus is not always successful, because the virus is often spread in a few minutes, before the aphid is affected by the poison.
5. Lettuce crops should be in blocks, as large as are practicable, separated from each other by as great distances, and as many other crops, as possible. This is particularly important during spring. New drillings should never adjoin much older crops, but it is usually safe to drill adjacent sections of a block at weekly intervals.
6. It is worth while to destroy diseased plants when thinning or cutting ; they should not be cut and left to wilt because this will not destroy the aphids, but will encourage them to move. It is a bad practice to leave diseased, unsaleable lettuce while the healthy are being cut, and then often for a period afterwards, before the remains of the crop are ploughed in. Unsaleable crops, or crop residues, should be destroyed as soon as possible.

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COLORADO BEETLE IN JERSEY: 1949 AND 1950

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SINCE the first outbreak of Colorado beetle in Jersey occurred in October, 1939, the States Department of Agriculture has taken energetic steps to deal with the pest by means of spraying and soil injection. During 1941–44, the period of German occupation, it was not possible for the Island authorities to deal adequately with the problem, but immediately on liberation a campaign was organized, aimed at the eradication of the pest. From that day to this the fight has continued, and the States Department has been unrelaxing in its efforts to prevent the pest getting a hold. Earlier chapters

in the story will be found in the issues of AGRICULTURE for January, 1947, March, 1948, and June, 1949.

1949 Invasion Despite the heavy seaborne invasions of Jersey in the spring of 1947 and 1948, very few Colorado beetles were found inland in the latter year. In 1949, no sign of the pest was seen until June 15, when 81 beetles (57 alive), together with swarms of ladybirds, were discovered on the east coast beaches. On the following day a total of 288 beetles (55 alive) were found on the east and north coasts, but subsequent finds were few and no further invasion occurred throughout the season. This small invasion took place when the wind was north-easterly ; it happened rather later than in 1947 and 1948 and was coincident with the later emergence of the hibernant beetles in north-west France. Of 62 live beetles examined, 47 were females (none gravid) and 15 were males.

The usual precautions of spraying the beaches and of spraying and inspecting the crops were taken. It is interesting to record that not a single live beetle was found inland in 1949, which clearly indicates the effectiveness of the measures taken in Jersey since 1945 and 1947, when many outbreaks occurred on the potato crops.

Three Invasions in 1950 In the period 1947–49 only one invasion occurred in each year, but in 1950 there were at least three. On May 10 there was a strong north to north-east wind, and inspection of the beaches resulted in the finding of many dead and live ladybirds, queen wasps and hornets, but no Colorado beetles. The Colorado beetle invasion began next day when sunny weather, combined with a north-east wind, prevailed and the tides were springing ; one dead and ten live beetles were discovered among seaweed along the high-tide mark in Grouville Bay on the east coast, and four dead ones at Greve de Lecq on the north coast. On May 12 43 beetles (23 alive) were collected in three east coast bays, and on May 13 the finds totalled 55 (29 alive), almost all of them being on the east coast. On May 14 and 15 the cool, strong, easterly winds continued, and the position rapidly deteriorated. On these days 1,603 adults (840 alive) were gathered on the east and north coasts ; many more were present but instead of collecting them, it was deemed advisable to spray the beaches immediately. Inspection of the south and west coasts failed to reveal the presence of the pest. After these dates many hundreds of dead beetles, but only a few live ones, were found, and by May 18, when the wind changed to south-west, it was evident that the invasion was at an end.

The second invasion began on May 26 when hundreds of beetles (many alive) reached the Grouville and other east coast bays, and many more were seen on the sea surface coming inshore with the tide ; ten beetles were found on the north coast and one on the south. Again, strong east winds prevailed and the tides were springing. Next day approximately 300 (many alive) were gathered on the east coast ; on the north coast 121 (63 alive) were found at Bouley and Bonne Nuit bays and at Greve de Lecq, where many hundreds were present—282 (18 alive) were picked up in 20 minutes. The situation eased on May 28 when, of the 565 beetles found on the east and north coasts, only 21 were alive. Numerous dead but no live specimens were seen on the south coast. The improvement continued next day. From then until June 2 many dead but very few live beetles were seen around the coasts.

The third and last, but heaviest, invasion of the year began on June 9, when the tides were springing and the weather was hot and sunny with a fairly strong north-east wind. In the evening beetles were washed ashore on the north coast at Greve de Lecq (1,006 were discovered, of which approximately 200 were alive) and at Plemont (554 were found, of which 45 were alive). On June 10 more than 3,000 beetles (91 alive) were picked up on the north coast and 350 (12 alive) on the east. During the next two days the invasion reached its peak. On June 11 approximately 7,000 beetles, many of them very active, were gathered on the east and north coasts ; many of the female beetles were gravid and eggs were laid on an inspector's hand. Short flights of a few feet were observed. On June 12, owing to a worsening of the situation, 101 schoolchildren, supervised by teachers, were called in to help. In two hours they collected 8,700 beetles (samples indicated that about 30 per cent were alive) from three bays on the east coast. High totals were also recorded on the north coast, and along the east part of the south coast 500 were found by two men over a 120-yard stretch. However, reports received from the east and north coasts between 9.30 p.m. and 10.30 p.m. showed that a sudden improvement had occurred coincident with a change in wind direction to the south-west. Seaweed began to drift out to sea instead of inshore and far fewer beetles were reaching the beaches. On June 13 and June 14 the wind was westerly and the total finds were less than 1,000, many of which were alive. During the next few days, however, it became evident that the invasion had ended because almost all the beetles found were dead.

On the Beaches and in the Field As in previous years, most of the beetles washed ashore were found among seaweed at the high-tide mark, but occasionally they were present below this mark, and at certain places, where the sea rises to the sea wall, specimens were discovered in the crevices. As soon as it is seen that many beetles are present on a particular beach, spraying with 5 per cent DDT dust is begun and the inspectors move on to the next beach. In this way the most heavily invaded areas are soon discovered and are treated without delay. When possible, treatment is repeated after each tide. Usually spraying is restricted to the sandy beaches and to the line of seaweed at the high-tide mark, but, where necessary, the sea wall is dusted. On rocky beaches, where spraying is difficult or impracticable, an effort is made to collect the beetles by hand, but many of them cannot be reached. In such places, however, and on pebbly beaches where the pest is found among and underneath the pebbles, it seems likely that many beetles are pounded and destroyed by the incoming tides, especially when the sea is rough and the tides are springing.

During these emergencies and for a few days after, inspection of the beaches is carried out daily from early morning to late evening, and as soon as time permits, the potato crops near the invaded beaches are carefully examined. Another precaution taken is to prohibit the collecting and carting of seaweed from the beaches to the fields.

One live beetle, the first to be found inland in 1950, was discovered on the windscreen of a car on June 5. From this date further single beetles (the total was 15) were reported from odd places such as a clothes line, a second storey kitchen in St. Helier, among grass cuttings from a bowling green, on a yacht, on an aeroplane, on runner beans, etc.

The first breeding colony was found on June 6 ; 13 adults, numerous eggs and very small larvae were present on volunteer potatoes growing

among weeds in a small area near one of the heavily invaded east coast beaches. Three more colonies were found in June, eight in July and two in August. Of the 14 cases, 11 were discovered by farmers or their workmen, and 3 by inspectors ; 11 of the outbreaks were quite small but in the remainder the infestation, although light, was scattered, the largest covering an area of 2 acres. In seven of the cases no finds were made after the end of July, and the last find of the season was a single beetle on August 29. The total number of adults found inland in 1950, including the single beetles, was 111.

In addition to feeding on potatoes, larvae were occasionally seen feeding, to a small extent, on tomatoes and *Solanum nigrum*. Seven of the outbreaks occurred on volunteer potato plants growing among weeds, tomatoes or root crops. These plants are a serious danger because, unlike planted crops which are frequently sprayed and inspected, they offer excellent concealed breeding places ; furthermore, such outbreaks are difficult to combat.

Treatment of the colonies followed the usual lines. In addition to spraying, inspection, and the planting of trap plants, preliminary soil injection was carried out at once, where necessary. To maintain a sequence of trap crops for inspection, both early and late potatoes will be grown in the infested areas in 1951.

As in previous years, and in accordance with the conditions of the licence granted to all growers of potatoes, precautionary spraying, supervised by Plant Protection Ltd., was carried out, using a combined Colorado beetle and Potato Blight spray. The material was provided free to growers, and farmers not in possession of spraying machines were able to hire them from the States' Committee of Agriculture. Spraying began on May 4 and was repeated at intervals throughout the season ; the fifth and last application began on August 29.

In addition to the fortnightly inspection by growers from May 1 to October 31, every crop must be examined for Colorado beetle by an official inspector immediately before it is lifted, or before the haulms are destroyed to control Potato Blight.

Collaboration between French and Channel Islands Authorities

Despite the six invasions of the past four seasons, there was only a slight crop infestation in 1948 and 1950 and none at all in 1949. It is evident that, with the invasions so far, the measures taken have been successful in preventing the pest from establishing itself on the Island. This excellent result is due largely to the co-operation and vigilance of growers, inspectors, members of the public and the staff of Plant Protection Ltd. However, the chief cause for concern at present is the possibility that, unless steps are taken to reduce considerably the number of beetles on or near the neighbouring coasts of France, weather conditions in any future season may be so favourable for beetle flights that the invasions may not be confined to the beaches of the Island.

In an effort to reduce the risk to the Channel Islands, close collaboration has been established, through the auspices of the European Plant Protection Organization, between the French and Channel Island authorities and scientists. In 1950 an intensive propaganda campaign was carried out in Brittany and Normandy and much assistance was given to farmers in the spraying of crops. Special emphasis has been laid on the value of late summer spraying to reduce the number of beetles going into hibernation,

because the Channel Islands invasions have always occurred in May or early June (the only exception to this was a very small one in Guernsey and Sark in August 1950), and it is the adults which hibernate in the previous autumn which constitute the main danger. It is not easy to persuade farmers of the need for late summer spraying because at that time a satisfactory crop of tubers has formed and little, if any, damage can be caused by the beetle. In addition, the farmer is busy harvesting at this season. Thus, at a time when the beetle population may be at its peak, spraying is liable to be neglected. On August 22, 1950, one of the writers was present in the Cotentin when an infested crop was treated with 5 per cent DDT dust. Before spraying it was estimated that there were 20,000 plants in the field and seven adult beetles per plant. The day after treatment, only one or two live beetles per plant remained—the treatment had destroyed at least 100,000 beetles.

In addition to the above activities, weekly reports on the incidence of the pest in Brittany and Normandy are sent to Jersey, and special observations are being made by French scientists on the emergence of the hibernants in the coastal areas in spring. In this way it is sometimes possible to forecast the imminence of invasions.

One fundamental difficulty is that at present the area or areas in France from which beetles migrate to the Channel Islands are not known—they may vary from year to year. If this information were available, special attention could be given to these areas. It is considered that there are three possible sources : (*a*) the Brittany peninsula where the potato acreage is very large ; (*b*) the Department of Manche where the relatively small potato acreage is made up of scattered crops ; (*c*) the Caen area where extensive potato growing is practised. As yet, none of these areas can be ruled out as a potential source of invasion, but the evidence available, although slender, indicates that the Cotentin peninsula is the most likely source. The swarms of beetles migrating from France must be very large indeed because, besides the many thousands collected on the Channel Islands beaches, very large numbers remain buried in the sands and pebbles, and numerous others are probably swept back on to the French beaches or out into the open sea. At one time it was thought that the potato acreage in the Cotentin was insufficient to support such large beetle populations, but this is not confirmed by later and more thorough inspections. In view of the above considerations, the Cotentin has been selected for the present for special attention.

Despite the increased activity in 1950, the risk of invasion of the Channel Islands in 1951 remains at a high level because the 1950 season has been so favourable for rapid multiplication of the pest.

FARMING AFFAIRS

Farming Cameo : 6. South Cheshire

Apart from the municipal borough of Crewe and the market town of Nantwich with its wealth of Elizabethan architecture, the southern part of Cheshire is wholly devoted to agriculture, unaffected by major industrial developments. In pre-war days the area was renowned for farmhouse cheese-making ; most of the land was under permanent grass and the majority of herds calved in

the spring. Now ley farming is practised to a limited extent on a large proportion of the bigger holdings, but milk production is for the wholesale market and, apart from a small number of cheese-makers, few farmers concentrate on spring milk.

The land lies between 120 and 260 feet above sea level, and is fairly flat, although a comparatively small area on the Peckforton and Bickerton Hills rises to 700 feet. Keuper Marl is the predominating geological formation, overlaid with varying depths of glacial drift, resulting in heavy wet soils in some localities and light sandy loams in others, with all intermediate types represented, particularly the medium-heavy loams. Annual rainfall is approximately 32 inches.

The district covers 93,700 acres of agricultural land, plus 740 acres of rough grazings. In 1950, 88,240 acres were devoted to the feeding of stock, the balance being mainly under wheat. Over the whole district the stock density is one cow equivalent to 1¾ acres, not allowing for 14,000 pigs and 390,000 poultry. Sheep numbered only 7,200 in 1950 and there are no herds of cattle devoted solely to beef production.

Most of the 1,940 holdings are small : only 4½ per cent are over 200 acres, 25 per cent from 10 to 50 acres, and 45 per cent under 10 acres. The smaller farms, in particular, are very heavily stocked with dairy cattle.

Herd improvement in this fertile, intensive dairying district is being greatly assisted by the availability of the A.I. centres of Tilstone Fearnall and Cheswardine, and T.T. milk production is steadily increasing, but expensive alterations to existing out-dated accommodation or erection of new shippons are very often called for. The yard-and-parlour system has not yet gained favour here. Self-contained herds are now found on almost every holding of over 50 acres.

Systematic ploughing of old pastures (generally phosphate deficient) is increasing, and direct reseeding, particularly on the heavier soils is gaining favour, but if the land is not naturally wet, a short rotation prior to reseeding without a cover crop or under arable silage is preferred. Nevertheless, numerous farmers still retain the comparatively large permanent pasture fields and have only a small proportion of their land under rotation. Tile drainage of a considerable acreage of "butted" pasture land* is required.

A noteworthy increase in silage-making has occurred during the last three years ; at least half the farmers with holdings of 80 acres or over are making quantities varying from 2 tons to 4½ tons per cow equivalent. This development has been made possible by the popularity of the pit method and the introduction of the buckrake, prompted by restricted supply and increased cost of feedingstuffs, unreliable hay harvest weather and difficulties with root crops due to heavy land and labour shortage. The 1950 acreage of mangolds and swedes in the district was only one-third of the 1944 area. The complete omission of hay from the winter rations of dairy stock is now a common practice on many farms.

Within the district there are only six privately-owned grass driers, but the large plant at Wardle and two plants operated by private contractors provide an extremely valuable service over a wide area.

*"Butted" pasture refers to land which was at one time cultivated under a system of ridges and open furrows to assist surface drainage. The distance between the ridges varied from 5 to 8 yards.—*Editor.*

There is no doubt that improved grassland management and more intensive use of lime and fertilizers is increasing agricultural production in South Cheshire, but if full advantage is to be taken of modern machinery and all land is to produce to its maximum, there remains ample scope for ploughing-up or further improvement of the old pastures.

H. E. Shaw, *District Advisory Officer*

Bearings Like most other kinds of machine, our farm machines depend for their operation upon rotary motion and therefore upon bearings. Indeed the wheel is the fundamental invention of all engineering. If tree trunks were used by prehistoric men as rollers to ease the work of moving heavy weights, they needed no bearings, and there was nothing to wear out. But as soon as the wheel was mounted on an axle, bearings had to be employed and inevitably bearing troubles must soon have been encountered. The bogy of "play" must be one of the oldest of engineering difficulties.

A bearing has to fit closely, yet not too tightly, and generally it must be lubricated. There are exceptions to this need for lubrication : an exception which does not concern us here is the jewelled bearings in watches ; another is the use of rubber-bushed bearings to allow partial rotation of shafts, and this use does concern us because bearings of this kind are employed in some farm machinery, and it is likely that their use will be extended. Our machines have to work in dusty conditions, and unless bearings can be perfectly sealed, the oil picks up grit which scratches the bearing surfaces. Rubber-bonded bearings do not suffer from this trouble.

When the lining of metal bearings has been worn away there is a sloppy clearance between the rotating member and the stationary member. The excessive clearance allows the bearing to vibrate and hammer, and this leads quickly to greater wear. If the machine is complicated, play in one of its bearings can bring misalignment in other bearings. Misalignment engenders poor running and further wear ; that is why some bearings for shafts are made free to twist a little so that they become self-aligning.

In farm machinery we have to deal with many different kinds of bearings, from simple iron-to-iron hubs on wagons to self-aligning ball-bearings on threshing machines. Some are adjustable for wear ; others have to be replaced when the play in them becomes excessive.

Clean lubrication is the best safeguard against wear, but it must be remembered that the range of lubricants available to us ranges from the thinnest of spindle oils to the thickest of greases, and since all nipples, oil ways and bearings are designed for some specific lubricant, the use of the wrong kind of lubricant may lead to trouble. For instance, if oil is used in a bearing which the designer intended to have grease, the oil may soon run out ; and if grease is used in a gear housing made for lubrication by oil, the gears may merely cut a channel for themselves through the grease, and very soon be running in a dry space surrounded by solid grease. The recommendation of the manufacturers of the machine as to oil grades should always be followed.

Some engine bearings are plain bearings. Steel shafts may rotate in a lining of white metal which is held in a housing. This white metal, composed of tin, antimony and copper, melts at a fairly low temperature. Therefore,

if the lubrication of the engine should fail, and the bearings become overheated, the white metal runs before any great damage is done.

Usually the lining and housing of plain bearings are built in halves. In some designs, the halves of the steel housing are separated by several thin packing washers called shims, and when the bearing has worn slack it can be tightened by removing some of these shims. In other designs the bearing can be adjusted only by filing away metal from the adjoining faces of the two halves of the housing. Only a very little metal must be removed, or the two halves of the bearing will fail to form a true circle. If the bearing is much worn it must be relined.

The shafts of the transmission gear of a tractor run in ball or roller bearings, and so do some of the spindles of threshing machines and combine harvesters.

Roller bearings designed to carry only radial loads have cylindrical rollers; bearings intended to carry side thrust as well as radial loads have tapered rollers running in tapered races. Bearings having tapered rollers can be adjusted for wear by removing some shims from the end of the housing, so that the rollers are moved farther along the tapered surface of the race.

Not all plain bearings have white metal linings. Some, such as the gudgeon-pin bearing in the piston of an engine, have a phosphor bronze sleeve separating the iron or steel surfaces. This sleeve wears away only very slowly, and when at last it does get slack it can be replaced.

Disc-harrows, which often have to run in a cloud of gritty dust, sometimes have the bushes of their bearings made of wood instead of bronze or other metal. Not only is the wood cheap to replace, but it makes a very good bearing surface, for, in use, it soon takes on a glass-like polish. Usually maple wood is chosen, and the bushes are hardened by boiling in oil before they are fitted.

H. J. Hine

Herd Instinct Influence on Grazing Behaviour Observations on the grazing habits of dairy cows in New Zealand are reported by John Hancock, Chief Animal Geneticist at the Ruakura Animal Research Station, in the October, 1950, issue of the *Empire Journal of Experimental Agriculture*. One of the points made in this interesting contribution refers to the effect of " herd law " on animal behaviour. "A herd pattern, for instance, exists especially in the case of the grazing activity, in that all cows tend, within limits, to begin grazing simultaneously. Partly, at least, this herd pattern is man-made and depends on such factors as the time at which the cows are taken in for milking and allowed out on the pasture, and on the type of sward they are grazing. However, the habit of unison grazing persists, even when the natural behaviour pattern is not interrupted by milking, i.e., when the cows are dry. The factors that determine the exact timing of each cycle are not known. No well-defined leader, for instance, has been noted which would initiate a new cycle. However, that some kind of 'herd laws' must determine the behaviour of cows on occasions is shown by the following. A herd of twins was divided into two lots, one of ten sets and the other of seven sets, and were subsequently grazed in adjoining enclosures, separated from each other only by a single wire. The herds were taken simultaneously to and from the milking-shed. It was repeatedly observed that the habits of the two herds were different in that all the animals of one herd could be in the midst of a grazing cycle while the cows in the other herd were all loafing or lying.

" The inclination to ruminate can be suppressed if most of the other cows continue to graze. It often happens that a few individuals after a short period of idleness in the middle of a grazing cycle begin to ruminate. When, however, the remainder of the herd moves away in search of feed, the ruminating cows tend to follow and, after a few minutes, stop ruminating and begin to graze.

" The herd instinct is also noticeable in the manner in which all cows tend to be concentrated in a relatively small portion of the enclosure. This inclination is strongest in periods of loafing or lying (especially during the night), but also when grazing it is unusual for cows to be spread over more than a quarter of a big enclosure (10–20 acres). In a smaller enclosure the dispersion is relatively greater, but regular herd movements are observable even under these conditions. In a long, narrow enclosure the herd moves from one end to the other ; in a squarish enclosure the movement tends to be circular. In warm weather dairy cattle stay closer together than otherwise, possibly in order to make the defence against the increased fly nuisance more effective. Extraordinarily rapid changes in this behaviour have been observed on warm days when periods of direct sunshine alternated with periods of clouds shading the sun. Immediately the sun appeared from behind a cloud the cows gathered together and continued to graze or loaf so closely bunched that one cow touched the other. They dispersed equally suddenly when the sun clouded over.

" Unusual disturbances, such as straying dogs and passing cattle, frequently result in the simultaneous abandonment of the normal current activities and a wild rush, accompanied by bellowing, is made toward the source of disturbance. After this has passed, all cows, whether they previously grazed or ruminated, tend to graze."

Agricultural Scholarships The Ministry of Agriculture and Fisheries invites applications for the undermentioned scholarships :

Ten Senior Scholarships, tenable at University Department of Agriculture, or Agricultural Colleges, for degree or diploma courses in an agricultural subject ; or at Veterinary Colleges for courses in Veterinary Science ;

Six Extended Junior Scholarships (for those who have already held Junior awards), and

Sixty Junior Scholarships, tenable at Farm Institutes or similar institutions, for courses not exceeding one year in duration, in agriculture, horticulture dairying, or poultry husbandry.

The scholarships are open to the sons and daughters of agricultural workmen or of working bailiffs, smallholders and other rural workers whose means and method of livelihood are comparable with those of agricultural workmen, and to persons who are themselves *bona fide* workers in agriculture. The value of the awards is such that neither the recipients nor their parents are normally required to make any contribution towards the cost of the training provided. The usual method of selection is by interview, no written examination being held, but candidates must be able to satisfy the Selection Committee that they are in a position to derive educational benefit from the proposed course of instruction and that they intend to follow an agricultural pursuit on completion of their training. Candidates for Senior scholarships must have attained the age of 17 and for the Junior scholarships should in general be not less than 17 years of age on September 30, 1951.

Full information concerning the scheme and forms of application may be obtained from the Secretary, (Room 314), 1 Cambridge Terrace, Regent's Park, London, N.W.1, or from the Education Offices of County Councils. The latest date for submitting completed applications is March 31, 1951.

Hannah Dairy Research, 1948–50 There is abundant evidence in this recently published three-year report ended March 31, 1950* that the Hannah Dairy Research Institute has an acute appreciation of its purpose to serve the needs of the dairy industry. Two contrasting lines of research may be quoted to illustrate this.

Because in modern times imported feedingstuffs have never been so scarce as they are now, the Institute has set itself, through a number of experiments, to examine the possibilities of the dairy farm becoming self-sufficient by grass alone, through close grazing, fertilizing and conservation. The results show that on good fertile land a dairy farm can maintain a high level of production without imported concentrates. It remains for the experiments in 1950 to show whether grass and grass products alone will suffice.

The second concerns the bacteriological control of milk. Here the Institute has investigated the reliability of creamery platform tests. The organoleptic test, which is the one almost universally adopted, is stated to detect only one-third of the unsatisfactory deliveries which had failed under a ten-minute resazurin test. To those who attribute the poor keeping quality of milk on the dairy platform to be largely due to long hauls of milk in hot weather, it will come as a surprise that in only about one-seventh of the milks did the temperature increase by more than 2°F., though the investigation was carried out during the months of July and August.

The report concludes with a list of eighty-six bulletins, special reports, reprints, abstracts of papers and other publications under the authorship of members of the staff of the Institute.

The Director of the Institute, Dr. N. C. Wright, is still seconded to the Ministry of Food as Chief Scientific Adviser ; during his absence Dr. J. A. B. Smith is in charge.

Colorado Beetle, 1951 : Standardized Potato Rowwidths Twenty-nine breeding colonies of Colorado beetles were found on potato crops in this country last year, and the Ministry will again this season be carrying out precautionary spraying of all potato crops in the "danger" areas, comprising parts of Kent, Surrey, Berkshire, Buckinghamshire, Hertfordshire, Essex, Suffolk, Middlesex and Norfolk. The Ministry asks potato growers in these areas to co-operate by adopting rowwidths of 28 inches. This will facilitate the conduct of the work by obviating the waste of time spent in adjusting wheel widths on machinery, and thus reduce the cost of the operations. Widths of 24 inches should not be used, as this involves readjustment of machinery, and even then it is difficult to avoid damage.

*Available free from the Hannah Dairy Research Institute, Kirkhill, Ayr.

THE MINISTRY'S PUBLICATIONS

Since the date of the list published in the December, 1950, issue of AGRICULTURE (p. 444), *the undermentioned publications have been issued.*

Bulletins Copies are obtainable at the prices mentioned from the Sales Offices of H.M. Stationery Office or through any bookseller.

No. 34 Mushroom Growing (*Reissued*) 3s. 6d. (3s. 8d. by post)

No. 97 Pests of Flowers and Shrubs (*Reissued*) 4s. 6d. (4s. 9d. by post)

Advisory Leaflets Single copies of not more than 16 leaflets (four in any group) may be obtained free on application to the Ministry, 36-38 Chester Terrace, Regent's Park, London, N.W.1. Copies beyond this limit must be purchased from the Sales Office of H.M. Stationery Office, net price 1d. each (2d. by post), or 9d. per dozen (11d. by post).

Group II Pests and Diseases of Farm and Horticultural Crops

(B) Fungi

No. 323 Sugar Beet Yellows (*Revised*)

Group VI Other Subjects

No. 133 Smallholder Cheese (*Revised*)

No. 247 Seed Testing for Farmers (*Revised*)

No. 320 Poultry Manure (*Revised*)

No. 375 Cloche Cultivation (*New*)

Animal Health Leaflets These leaflets are obtainable under the same conditions as for Advisory Leaflets (see above).

No. 42 Stomach Worms in Cattle (*New*)

Grow more Leaflets Issued free and obtainable only from the Ministry, at 36-38 Chester Terrace, Regent's Park, London, N.W.1.

No. 10 Surplus Potatoes (*Revised*)

No. 81 Kitchen Waste for Pigs and Poultry (*Revised*)

Fixed Equipment of the Farm Leaflets Single copies of any one of the leaflets in this series may be obtained free on application to the Ministry, 36-38 Chester Terrace, Regent's Park, London, N.W.1. Larger quantities must be purchased from the Sales Offices of H.M. Stationery Office, price 3d. each (4d. by post), or 2s. 6d. per doz. (2s. 7d. by post).

No. 5 The Milking Parlour (*New*)

Other Publications

Report of the Committee on Qualitative Control of Seeds
1s. (1s. 1d. by post)

Agricultural Improvement Council Second Report
1s. (1s. 1d. by post)

AGRICULTURAL INDEX NUMBERS

MONTHLY INDEX NUMBERS OF PRICES OF AGRICULTURAL PRODUCTS
INCLUDING EXCHEQUER PAYMENTS (UNCORRECTED FOR SEASONAL VARIATION)

BASE 1927–29 = 100

	1950			1949		
	Oct.	Nov.	Dec.	Oct.	Nov.	Dec.
All Products	254*	270*	279*	242*	257*	264*
Cereals and Farm Crops	229*	240*	247*	215*	218*	223*
Livestock and Livestock Products	264*	282*	291*	253	273	281
Wheat	266	271	273	236*	236*	238*
Barley	275	306	314	239	242	242
Oats	239	241	250	220	226	239
Potatoes	189*	194*	204*	192*	197*	205*
Hay	217	247	255	199	205	212
Fat Cattle	197	197	205	196	198	204
Fat Cows	167	161	161	160	152	152
Fat Sheep	200	200	202	196	204	208
Fat Ewes	191	194	197	185	188	191
Bacon Pigs	313	313	313*	275	275	275
Pork Pigs	269	269	269	253	253	253
Sows	228	228	228	204	204	204
Milk	296*	330*	343*	283	317	330
Butter	114	114	114	86	86	86
Poultry	267	268	305	236	236	239
Eggs	275	275	266	286	303	303
Store Stock †	180	180	185	183	186	187
Dairy Cows	199	201	197	210	210	207
Store Cattle	216	206	208	197	194	194
Store Sheep	398	386	369	285	276	276
Store Pigs						

* Provisional.

† Not included in general index.

Agricultural Statistics, England and Wales, Part II. 1945-7

Part II of Agricultural Statistics for 1945–47 contains four principal groups of agricultural prices : *Market prices* as recorded by trained observers ; *statutory or scheduled prices* for commodities under control ; *index numbers prices* showing the general trend of agricultural prices ; *agricultural output prices* used in estimating farmers' gross receipts. Obtainable from H.M. Stationery Office, or through any bookseller, price 2s. 6d. (2s. 9d. by post).

"AGRICULTURE" INDEX

The Index to Volume LVII will be issued with the April number.

BOOK REVIEWS

The Story of our Cattle (Young Farmers' Club Booklet No. 22). E. J. Roberts. Evans Bros. 1s. 6d.

The Story of our Cattle by Professor E. J. Roberts gives a brief history of the domestication and development of our cattle from centuries before Christ to the present day. The part played by environment and the contribution made by successive invaders of British soil, each bringing their own cattle, well explains the localization of breeds. The whole story is told in an imaginative style, which is particularly well illustrated in the chapter describing the hardships and risks attendant in the lives of the cattle drovers of the pre-railroad era; not only was courage required, but integrity for the responsibility of large sums of money which were sometimes carried. British Friesian breeders will be interested in the account of the importations of Dutch cattle between A.D. 1500 and 1700—accessions which appear to have played an important part in the development of some of our breeds.

The necessity in the middle of the eighteenth century to produce more food for the growing population caused what is described by Professor Roberts as "The Great Awakening," and threw up methodical improvers such as Bakewell and, a century later, Mendel. Progress followed rapidly in all breeds, and this is depicted in the illustration of past and present specimens of cattle. Although certain names, such as Bates and Collings, have been associated as the successors of Bakewell, the part played by hundreds of anonymous breeders and their stockmen has not been forgotten; they have all made their contribution to the world-wide reputation of British stock. The introduction of milk recording has placed the breeding of dairy cattle on a much sounder basis. For the critical breeder, one year's good yield is not enough: quantity and quality over a long period are needed to judge an animal's staying power. And he wants accurate information about the performance of all her relations. Disease-free, progeny-tested animals and artificial insemination promise quicker wholesale improvement than seemed possible years ago.

Professor Roberts is to be congratulated on his booklet for the Young Farmers. It is one indeed which could be read with interest, and perhaps advantage, by old farmers as well as young.

H.T.

A Physical Land Classification of Northumberland and Durham and part of the North Riding of Yorkshire. North East Development Association. 30s.

In arguments about the diversion of land from agriculture to other uses (such as housing, industry and opencast minerals), people talk about good and bad agricultural land. Yet so often they do not define what they are really talking about. Land can be good for one purpose, such as growing carrots, and much poorer for another agricultural use such as growing beans. Land near a big town or with good communications is much more valuable agriculturally than similar or even better quality land farther away. There is, then, a whole series of factors which can be used to classify the value of agricultural land—physical ones like soil (its structure and some chemical properties) and site (elevation, slope, aspect, rainfall, temperature, and so on) and, in addition, man-made factors such as situation of the land and farm in relation to markets and local farming traditions.

This book sets out to be a physical land classification only, and it tries, as the company of authors point out, to show the broad differences in the inherent fertility of land in the north-east by weighing up differences between areas in their site and soil and ignoring the influence of history and economics. I know of no land classification in Great Britain which takes into account economic, historical and land use data. Combined analyses of this nature have been done in other countries, particularly in the United States of America, and these reports try to assess the capabilities of soils and land areas for *potential* uses.

The book is tastefully produced (a compensation for its high price) and gives written analyses and maps on the general geographical background of the north-east, its climate, geology and soil characteristics. This is followed by a discussion of the more important areas that fall into different land uses. The book is a valuable background to persons interested in and working amongst the farms of this large area of England.

One critical point. The authors mention that they have included in their high category IA the larger areas of market garden land in the region, many of which have been developed on soils not of an inherently high quality and which owe their high fertility to intensive cultivation. To do and say this is to make allowance for the influence of economic factors, and this surely is incorrect in a land classification which sets out to be a physical one only.

G.P.W.

BOOK REVIEWS

Plant Pathology. Sir Edwin J. Butler and S. G. Jones. Macmillan. £3 3s.

One of the modern classics of plant pathology was Butler's *Fungi and Disease in Plants*, first published in 1918 and long since out of print. The present, much-enlarged volume is a version of Parts I and II of that work. The first part on "General Principles" is a delight to read and should be studied by every student of plant pathology. The second part, describing the most important plant diseases occurring in Britain today, is full of detailed information, and well illustrated by photographs and drawings. It is the only available summary of present-day knowledge on the 170 diseases of agricultural and horticultural crops that are of economic importance in this country and is an invaluable work of reference. The information given is remarkably accurate, although some obscurity has crept in here and there—hardly surprising considering the difficulties in condensing the enormous mass of data.

The book is written primarily for university students and is therefore essentially academic in outlook. Its only serious weakness is an apparent lack of practical knowledge and outlook in the directions for disease control. Too often a selection of control measures is quoted from the literature without any indication of their relative value, and therefore provides no guide to the grower as to the precise methods he should adopt. This is particularly the case with Tomato Foot Rot, Stem Rot, and Tulip Fire, and broccoli growers will smile at the instruction to remove the affected tissues and burn all plant debris for the control of Ring Spot. Furthermore, the general section on fungicides, which is such a large and important subject today, covers only nineteen pages. To remedy these omissions, however, an already bulky volume would have to be expanded to quite unmanageable size. As it is, the book comprises 979 pages and the publishers are to be congratulated on the attractive and serviceable way in which it has been produced.

A.B.

The Law of Agricultural Holdings. W. S. Scammell. The Royal Institution of Chartered Surveyors and The Chartered Auctioneers' and Estate Agents' Institute. 25s.

This is an important book and one primarily for the legal and land agency professions rather than the farmer or the general reader. The author has thoroughly mastered the 1947 and 1948 Acts and is not afraid to demonstrate this by avoiding what he himself describes as slavish following of the exact sequence. The Plan and the Detailed Arrangements of Sections are a guide to how best the book may be used and are to be commended warmly to other writers of similar works dealing exhaustively with a complicated subject. Part I of the Agriculture Act, 1947, which deals with the provisions for guaranteed prices and assured markets, is wisely given due prominence, since the following Parts II and III are closely dependent upon it.

The author's notes on the text are the really important content of the book. They could be longer and still command the reader's close attention. The chapter on Notices to Quit is, however, first-rate and includes a full discussion of the difficult hardship case, incidentally giving Lord Halsbury's definition of discretion. The Compensation Provisions are well explained, and especially clear are the notes on the uncommon "high farming" provisions of Section 56 of the 1948 Act. There is an ease of exposition which makes the book very readable, and Mr. Scammell's literary style is attractive with the refreshing simplicity and directness of one who has a comprehensive knowledge of his subject.

R.G.A.L.

Mushroom Science—1. Proceedings of the First International Conference, 1950. 7s. 6d.

In May, 1950, the first International Conference on Mushroom Science was held at Peterborough, the object being "to assemble research workers and others interested in the application of scientific methods of mushroom growing, for discussion on recent developments, current problems and future programmes of research". About 30 papers, covering a wide range of mushroom cultivation, were read by both European and American contributors, and these now appear, either in full or summarized, in book form.

The subjects dealt with include composting, cultivation experiments, the use of new insecticides and fungicides, and the heating of beds. The methods of cultivation in different countries are contrasted, and reference is made to two new diseases (La France and Vern Astley) which have appeared in the United States and Canada.

D.H.

BOOK REVIEWS

Marketing Poultry Products (4th Edition). E. W. Benjamin, H. C. Pierce and W. D. Termohlen. Chapman and Hall. 36s.

The fourth edition of this American publication is certainly a comprehensive study of the subject, and there can be little doubt that it is the best available publication of its kind. It is factual on proven points, but has the merit of approaching many problems without dogmatism of any kind. The output of eggs and poultry in the United States is far greater than that of any other country in the world; the problems, too, are considerable, owing to the great distances which produce usually has to travel before reaching the consumer. Consequently, refrigeration is an important and rather costly factor.

A chapter on "The Egg" contains the truism that, with the single exception of milk, it would be difficult to name a more complete food than the egg. "Poultry and Egg Packing Plants" supplies much food for thought, and not least the fact that a high proportion of packers pack both commodities and often other products as well. Plants are usually sited near important centres of production and most of them have provision for conditioning and fattening birds on the premises. "Feeding Station Operations" contains a wealth of important information, with useful tables on the composition of food and its effects on the conditioning of birds. Incidentally, pellet feeding is strongly recommended. The chapter on "Distributors" contains the timely hint to producers: "the greater the care and expense given to the product on the farm, the less is the probable cost and wastage during distribution". Lists of the most important trade associations and their functions indicate that several of them represent not only producers but processors and other interested parties as well. Co-operation in general appears to be gaining favour. "Prices and Marketing Reporting" contains another apt saying, "Good quality encourages increased consumption," and there are a good many lessons to be learned from the chapter "Retailing Eggs and Poultry," the most important, perhaps, being the demand in congested areas for good cut up poultry. Another good chapter is "Use of Eggs and Poultry," in which both products get the praise they are entitled to from a nutritive point of view.

The photographs and diagrams are of a very high order, as also is the general layout which, coupled with good paper and printing, makes for easy reading. It is a pity that there is no parallel work dealing with conditions in the United Kingdom, but even so producers and packers here can learn many lessons from this book.

A.P.F.G.

Introgressive Hybridization. Edgar Anderson. Chapman and Hall. 18s.

The occurrence of hybridization and its effect on plants in the field have important results for both theoretical and practical workers. The recognition and study of the effects form the subject of this useful little book.

Unlike many who have written on this subject, the author stresses the restrictions on recombinations of parental characters. He presents the problem as the intrusion, or introgression of one parental species into the other by out-crossing followed by repeated back-crossing. He shows that it is possible, by suitable methods of scoring and analysis, to induce a description of the intruding species, even if the latter is not known.

The book is simply and clearly written and adequately illustrated. To the reviewer its main defect, apart from its price, is a too-ready identification of characters with genes, with the consequence that the importance of linkage in the restriction of recombination is, one feels, exaggerated. A salutary corrective would be a study of D'A. W. Thompson's *Growth and Form*.

J.L.F.

Farm Incomes in England and Wales 1944-5 to 1947-8. H.M.S.O. 10s. 6d.

A report summarizing the results of the Farm Management Survey and entitled Farm Incomes in England and Wales 1944-5 to 1947-8 is the first of a series which the Ministry of Agriculture hopes to issue yearly. The greater part of the report consists of tabular statements of the survey material, with brief commentaries thereon. Much hitherto unpublished material is thus made available to the research worker, and the general reader is given a detailed picture of post-war trends in the economic condition of farming in England and Wales.

D.H.

Long Ashton Research Station Annual Report, 1949. University of Bristol. 12s.

The production of cider fruits in grass orchards has been a feature for many decades in western counties, but growing cider apples by the bush method is a more recent development which started in 1935, and progress records have appeared in several annual reports. Six centres were established in the Province, with an outside area at Faversham in Kent. The Research Station plot comprises 8 acres and the sub-centres 2 acres each. In the tables, the varieties are classed in the order of yield. The Report adds that it has not yet been proved that such vintage varieties as Foxwhelp, Silver Cup and Knotted Kernel will prove satisfactory as bush fruits, although they give good yields as standards.

A progress report on plant breeding by G. T. Spinks, deals with the origin of the apple Cheddar Cross—the parents being Allington and Star of Devon. Three seedlings from parentage Worcester and Beauty of Bath are promising to precede Worcester. Many young apple seedlings have been raised in an attempt to obtain good early and late sorts. Successful late plums are Seven Cross, Thames Cross, and Frome Cross. An attempt is being made to obtain blackcurrant varieties with a higher vitamin C content.

In an account of experiments on subsoil injection for Nutrient Placement in Relation to Fruit Tree Nutrition, the distribution of injected solutions is shown to be more restricted than was expected, and trials have not yet shown any increased uptake.

The investigation of zinc and copper deficiency of fruit trees, began in 1948 at the National Fruit Trials, Wisley. The zinc content (Table I) and copper content (Table II) on the affected and normal soils are in sharp contrast. Both branch injections of solid zinc sulphate and sprays on the foliage during dormancy have proved effective in apples affected with zinc deficiency. With copper deficiency, injection with solid copper sulphate has given results; experiments are not yet concluded in testing soil applications of copper sulphate and foliage sprays. A further contribution to molybdenum deficiency in brassica crops is included and gives a description of visual symptoms in certain Brassicae.

Mr. R. S. Willison, of the Dominion Laboratory of Plant Pathology, St. Catherine's, Ontario, Canada, contributes an account of field observations for virus-like symptoms on stone fruit in southern England. The symptoms on cherries, plums and peaches are discussed. It is contended that the distribution of these virus diseases is more widespread than is sometimes appreciated.

A report on the observations on "Rubbery Wood," "Chat Fruit" and "Mosaic" in apples during the past five years by L. C. Luckwill and S. H. Crowdy is very detailed. Apple Mosaic apparently has a wide range of susceptible varieties, and symptoms are more apparent in the drier summers. These two research workers have also added a preliminary account on "stunt" disease of plums. Infected trees have been observed in the West Midlands and in the southern parts of eastern and western counties.

Mr. R. J. W. Byrde, Dept. of Horticulture, University of Reading, reports the control of Brown Rot of fruits by spraying under field conditions with phenyl mercury chloride, Phygon "XL" or copper quinolinolate, under June conditions. The conclusions concerning the use of phenyl mercury chloride as a winter spray is deferred.

An account is given by Mr. S. H. Bennett of experiments with systemic insecticides for the control of Green Apple Aphid where the insecticides were applied to the soil, or the leaves and stems.

A 1949 Revision of a Summary of Fruit Spraying Programmes has been contributed by Mr. H. G. H. Kearns and Mr. R. W. Marsh. This modification is due to the introduction of new materials, and more technical knowledge of the older substances.

Mr. H. G. H. Kearns and Mr. W. G. Morgan compare automatic spraying of top fruit using a spray "mast," with older methods. It is pointed out that this method may not be applicable to some existing orchards.

C.H.O.

British Insecticides and Fungicides for Crop Protection, 1950.

The Association of British Insecticide Manufacturers has published a comprehensive directory relating to insecticides and fungicides. Directed principally to overseas buyers, the introduction, printed in English, French, Spanish, German, Portuguese and Russian, indicates the scope of the services offered by member companies of the Association to growers at home and abroad. Following sections give details of member firms, of their products and services and their trade names and marks. Colour charts, showing the various stages of fruit bud development in relation to the spraying programme, are reproduced from Ministry of Agriculture Bulletin No. 137.

Copies of the Directory are available from the Secretary of the Association, 166 Piccadilly, London, W.1.

D.H.

BOOK REVIEWS

Manual of Cultivated Plants (Revised Edition). L. H. Bailey. Macmillan. 87s. 6d.

The new edition of this standard work by L. H. Bailey, the grand old man of American botany and horticulture, now over 90 years of age, author of the well-known *Cyclopedia of American Horticulture* and many other books, will be welcomed by all who are familiar with the earlier edition which appeared in 1923. The book contains brief descriptions and keys for identification of those plants which are in cultivation throughout the United States and Canada, representing in all over 5,000 species.

The plants dealt with include all the food and decorative plants or those grown for utility or general interest throughout North America, both in the open and under glass. This naturally includes all the fruits and vegetables, in themselves large groups and comprising practically all the known fruits and vegetables of temperate and subtropical regions, as well as many usually associated with the tropics. Cereals, pulses, root crops, cover crops, oil and fibre plants, drugs, spices, timber trees, street trees, decorative trees and shrubs and garden plants generally—all are included. The common name or names, country of origin and brief descriptive notes are given separately under each species.

Many of the plants, both decorative and economic, grown in the northern United States and in Canada, are cultivated also in the British Isles and in similar latitudes in other lands. Consequently, although the book is intended primarily for American readers, it will be of value to those interested in such plants in other countries. The present edition is considerably larger than the original, dealing with some two thousand more species. It also has the value of being more freely illustrated with good line drawings.

F.N.H.

Essex (County Books Series). C. Henry Warren. Robert Hale. 15s.

There is nothing matter-of-fact or guide-bookish about Henry Warren's *Essex*. It is an appreciation of the land and people, of the history and historic buildings, of the customs and whimsical speech of country folk, of estuaries, eerie marshes and seaboard, of wild fowl and fowling, and of the immense production of what I (with my Essex associations!) regard as England's best-farmed county.

To many, Essex has an evil reputation. The day or weekend tripper on his rush from London and its suburbs to the coast sees on almost every hand, the havoc wrought to a once attractive and fertile countryside by the land speculator and by the shack and jerry builder.

Agriculturally, Essex is known as having clinging to her feet many acres of heavy, wet, tenacious and intractable clay which in the 'eighties and 'nineties brought to ruin her native yeomen and attracted to low-priced holdings dairy farmers from Scotland and from north-west and south-west England. It is true that much of south Essex has been abominably treated by the hand of man. It is true also that one-third of the surface soil and two-thirds of the subsoil is composed of London clay. Nevertheless, real Essex is a lovely county, and above all, highly productive and highly farmed by a race of workers unsurpassed in the skills of husbandry.

But to know Essex, Mr. Warren points out, means travelling the tortuous lanes and by-ways with which the county abounds, with frequent stops at viewpoints from which the charm and character of the countryside can be enjoyed. He writes of the Roothings, perhaps the best corn-growing area in England, stretching from Chelmsford to Bishop's Stortford, at no point more than 30 miles from London and yet so remote. He writes of the rich colours of vegetables and flowers grown for seed, of the fields of roses, of the plantations of richly coloured apples and fruits and of the cricket bat willow. He brings out the great wealth of a well-farmed county, the cradle of the Essex pig, and the adopted home of the British Friesian.

The book is fittingly dedicated to an Essex gentleman—Mr. Frank Cullen, a grower of seed crops and the owner and keeper of the former home of the Knights Templar—Cressing barns.

J.C.L.

More Old English Farming Books (From Tull to the Board of Agriculture, 1731 to 1793). G. E. Fussell. Crosby Lockwood. 15s.

The Agricultural Revolution was a vast and incoherent movement which produced a literature hardly less vast, and certainly not less incoherent. Indeed seldom can so many people of such different types have written so voluminously on farming as they did in the reign of George III. Mr. Fussell, however, has proved himself as informed and skilful a guide to the confused mass of publications produced by the first half of the Revolution as he has to so many other aspects and periods of rural history.

He starts with Tull, whose scientific reflections on plant life appear to have aroused more contemporary interest than his invention of the drill, and traces the development of farming literature through the crowded sixty years that followed. Some of the writers he discusses are famous, others obscure, and though many were, or at least claimed to be, professional farmers, the urge to write on rural matters appears to have been remarkably widespread, afflicting doctors and country clergy with peculiar severity. We owe, for instance, the mangel-wurzel to a medical man, and the prototype of the Suffolk drill to a parson. Indeed it is a varied collection of men who are passed in review and whose writings are summarized and assessed, and the book ends with the establishment of the Board of Agriculture, through which the State itself was to enter, for the first time, the field of agricultural literature. It is, however, unfortunate, though understandable, that the early *Correspondence of the Bath and West Society*, which adds so much to our knowledge of farming in the later years of this period, could not be included in the term "book".

More Old English Farming Books follows Mr. Fussell's classic survey of English farming literature from 1523 to 1730, and his readers will certainly look forward to the fulfilment of his modestly-expressed wish to publish another similar work for the period 1793–1840.

C.N.H.

Birds and Men (New Naturalist Series No. 17). E. M. Nicholson. Collins. 21s.

A reliable work of this kind was overdue, since the importance of the impact of man on birds, and of birds on man, has long been realized by ornithologists. That it has come at last from the pen of Mr. E. M. Nicholson is a matter for congratulation to both author and reader. As Mr. Nicholson is a distinguished civil servant as well as a distinguished ornithologist, the reader is assured not only that the subject has been fairly and faithfully dealt with but that the book is written with real knowledge and authority.

In the chapters on birds in relation to agricultural and horticultural man, the author has said some things that badly needed saying. For example, his comment on the too drastic trimming of hedges and its effect on nesting should be read by all who appreciate the value of our farmland birds. In his chapter on birds in gardens, the author says that there are far too many cats. How right he is, and how plucky of him to say it!

I was glad to note a timely and well-deserved tribute to the raven, and heartily concur with the author's views on the increasingly bad character of the carrion-crow. I wonder, however, whether he has not under-estimated the stock-dove, both as regards its numbers and its potentiality to do harm. As to the wood-pigeon, the author says "it would be rash to conclude that the farmer would be ruined or that the production of food would be significantly reduced even should a large increase of wood-pigeons occur." Maybe. But many a farmer can testify that a local concentration of wood-pigeons can spell, if not ruin, a serious loss for the year.

In this as in all books, no matter how eminent the author, there are other things one is tempted to query; but there can be no dissention from the view that this book, as stated by the publishers, is "one of the most important contributions to the literature of British ornithology of recent years." Like others in its series, it is excellently produced, and with illustrations in colour and black and white.

F.H.L.

Guide to British Insects. B. D. Morton. Macmillan. 8s. 6d.

In the compass of some 170 pages the author has succeeded admirably in producing a book which is a useful and well illustrated elementary guide to the identification of British insects. It should prove of real value to students of agriculture, young farmers and gardeners.

There are well over twenty thousand different kinds of insects in Britain, so that inevitably a small book can give a guide only to families and groups of insects. Pages 41–53 consist of a key by means of which it is possible to place insects in their family groups. The evolution of this key must have been a difficult and intricate task, but the author has undoubtedly achieved his aim.

This book is not a popular account of insects and insect habits; on the contrary it is an elementary text-book and as such it meets a long-felt want. So many books on entomology, of a popular and semi-popular nature appear from time to time, that it is difficult for the beginner to make a choice—the publication of this guide will obviate that difficulty. The illustrations are very good; the line drawings in particular are simple, well-balanced and illustrative of the text. The book is well produced on good paper and is excellent value for 8s. 6d.

I.T.

BOOK REVIEWS

Good Control of Plant Diseases (Teach Yourself Farming Series). H. H. GLASSCOCK. English Universities Press. 4s. 6d.

For a long time there has been a dearth of books dealing with the control of plant diseases and insect pests. In recent years, however, publishers have realized that there was a real need, both by farmers and students, for books on this important subject, and many are now available. The latest is *Good Control of Plant Diseases*, a welcome addition to the Teach Yourself Farming series. The author is a practising plant pathologist, who has had a wide experience in advising farmers, and also in investigating plant disease in the field.

The book is written simply and, wherever possible, technical terms are avoided. The subject-matter is divided into eleven illustrated and self-contained chapters. An introduction dealing with the nature of plant ailments paves the way for a study, in subsequent chapters, of the diseases of potatoes, cereals, vegetables, tomatoes and fruit. Chapters are devoted also to nutritional disorders, fungicides and methods of control.

Good Control of Plant Diseases is a very inexpensive and handy little book, which will be of value to students who have just started to make a study of the subject. It will also serve as a useful companion volume to another book in this series—*Good Control of Insect Pests*.

The farmer can also profit from the experience of the author but he should note the remarks with which Mr. Glasscock so shrewdly concludes. "The diagnosis and treatment of human and animal ills is generally admitted to be most safely delegated to those who have achieved skill from a rigorous course of training. With sick plants the sentimental and legal aspects are more frequently absent, and there is a greater tendency for the grower to chance his own diagnosis and treatment." It is for this reason, therefore, that the author suggests when a farmer is in doubt he should seek specialist advice from within the National Agricultural Advisory Service.

W.A.R.D.W.

Farming and Mechanised Agriculture (4th Edition). Edited by Sir George Stapledon. Reference Books Ltd. 25s.

Here is a reference book with a difference, for it supplies not only the various facts and figures that one would normally expect from a book of reference, but also contains concise notes on the construction, objects and work of the Government Department and public and private bodies connected with the agricultural industry, together with information respecting agricultural legislation and policy. The volume opens with an article by The Editor on the agricultural situation ; the closing section is devoted to lists of agricultural books, periodicals and films, arranged alphabetically under subject headings. In between is a wealth of information likely to be of value to the agriculturist, including a directory of organizations interested in farming and mechanized agriculture, and a section covering officially appointed Committees.

D.H

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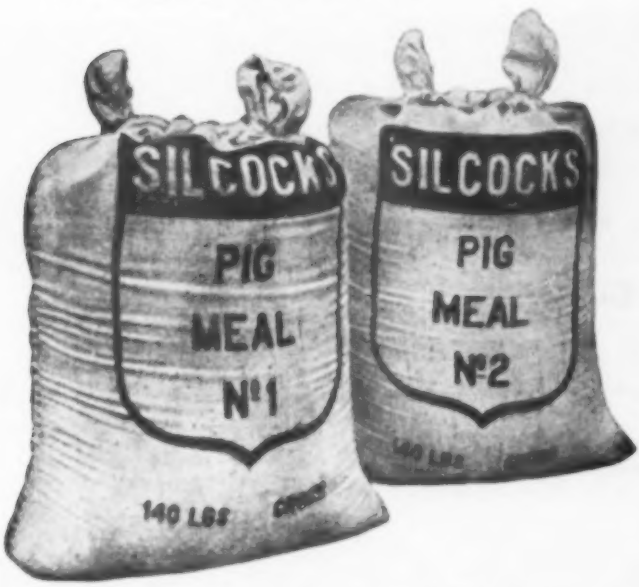

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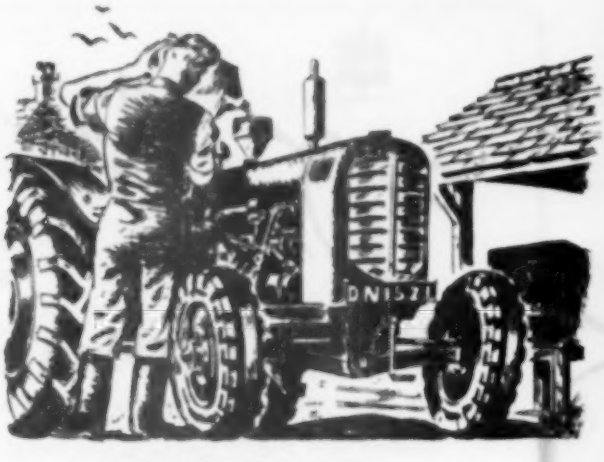

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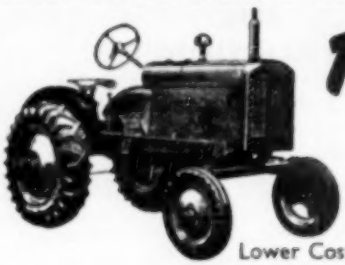

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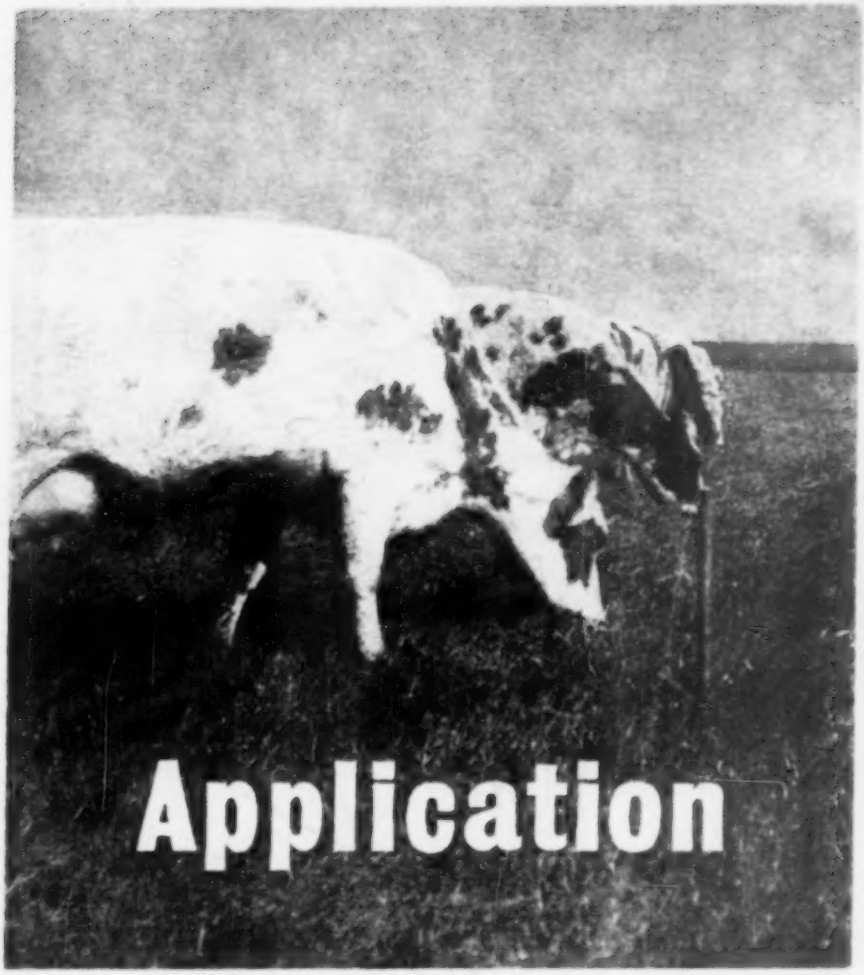

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